A NEW SPECIES OF *CATHOROPS* (SILURIFORMES; ARIIDAE) FROM MESOAMERICA, WITH REDESCRIPTION OF FOUR SPECIES FROM THE EASTERN PACIFIC

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ABSTRACT

The great similarities in the external morphologies and the lack of knowledge on ontogenetic and intersexual differences of species in the ariid genus *Cathorops* Jordan and Gilbert, 1882, has led to an abundance of misidentifications, causing great nomenclatural instability. Accordingly, the taxonomic statuses of the *Cathorops* species described from Eastern Pacific have remained controversial in the literature, even in recent studies. Here, we describe *Cathorops raredonae*, a new species from Mesoamerica (Mexico to El Salvador) and redescribe (in *Cathorops*) *Tachysurus liropus* Bristol, 1897, and *Arius taylori* Hildebrand, 1925, often listed as junior synonyms of *Cathorops fuerthii* (Steindachner, 1877) and *Cathorops steindachneri* (Gilbert and Starks, 1904), respectively, or treated as species inquirendae in *Cathorops*. We also redescribe and redefine the circumscriptions of *C. fuerthii* and *C. steindachneri*. Finally, we summarize current statuses of nominal species of *Cathorops* from the Eastern Pacific and provide an artificial key to identify the valid Pacific species.

The neotropical genus *Cathorops* Jordan and Gilbert, 1882, comprises species that inhabit mostly estuarine and marine waters, but also includes some species restricted to freshwater. The genus is distributed from Mexico to Peru in the Eastern Pacific and from Mexico to Brazil in the Western Atlantic. Currently, 16 species of *Cathorops* are considered valid (Betancur-R. et al., 2007; Marceniuk, 2007a; Marceniuk and Betancur-R., 2008), but a number of additional entities await formal description or resurrection. The genus *Cathorops* is easily distinguished from other New World ariid genera (see Appendix I) and its monophyly is well supported on morphological and molecular grounds (Betancur-R. and Acero, 2005; Marceniuk and Menezes, 2007). Betancur-R. et al. (2007) hypothesized relationships among 13 species of the genus using mitochondrial evidence and recognized two subgenera, the monotypic *Precathorops* for *Cathorops dasycephalus* (Günther, 1864) and *Cathorops* for the remaining species (Fig. 1).

The overall similarity of external morphology and coloration, combined with the lack of knowledge on ontogenetic and intersexual differences among species, have traditionally precluded the correct identification and delimitation of *Cathorops* species. For instance, several ichthyologists from the 19th and early 20th centuries have diagnosed species based on sexually dimorphic characteristics that are otherwise interspecifically invariable (Valenciennes, 1840; Boulenger, 1897; Gilbert, 1898; Starks, 1906). Moreover, some nominal species have been incorrectly applied to different unrelated species [e.g., *Pimelodus spixii* Agassiz, 1829 and *Arius melanopus* Günther, 1864 (Taylor and Menezes, 1978; Jordan and Evermann, 1896; Acero, 2003)] and others have been questionably synonymized or listed as species inquirendae in *Cathorops* (Kailola and Bussing, 1995; Marceniuk and Ferraris, 2003; Marceniuk and Menezes, 2007). While some recent progress has been made towards untangling the taxonomy of *Cathorops*, particularly the species from the Western Atlantic (Betan-

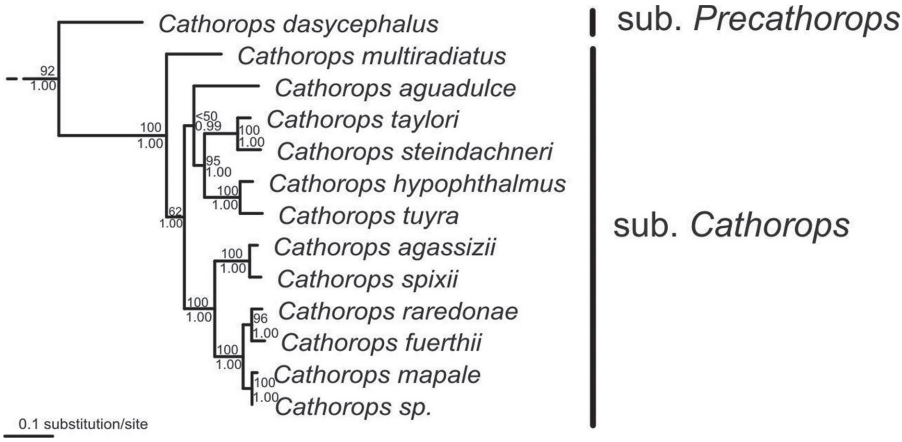

Figure 1. Bayesian phylogram (BI) on 2842 mitochondrial sites (cytochrome b, ATP synthase 8/6, 12S, and 16S). The BI topology is fully congruent with maximum parsimony (MP) analyses. Numbers above and below nodes indicate MP bootstrap and BI posterior probability support values, respectively (after Betancur-R. et al., 2007). *Cathorops raredonae* referred as *C.* aff. *fuerthii* in Betancur-R. et al (2007).

cur-R. and Acero P., 2005; Marceniuk, 2007b; Marceniuk and Betancur-R., 2008), the statuses and relationships of the Eastern Pacific *Cathorops* have remained largely in disarray (but see Marceniuk, 2007a).

Taxonomic revisions during the last two decades have validated between five and seven species of *Cathorops* from the Eastern Pacific (Allen and Robertson, 1994; Kailola and Bussing, 1995; Marceniuk and Ferraris, 2003; Marceniuk and Menezes, 2007; Marceniuk, 2007). Although the validity of statuses of *C. dasycephalus*, *Cathorops hypophthalmus* (Steindachner, 1877), *Cathorops manglarensis* Marceniuk, 2007, *Cathorops multiradiatus* (Günther, 1864), and *Cathorops tuyra* (Meek and Hildebrand, 1923) have not been disputed in any of the recent works, there is a great deal of uncertainty regarding the validation and/or delimitation of the nominal species *Arius festae* Boulenger, 1898, *Arius fuerthii* Steindachner, 1877, *Arius taylori* Hildebrand, 1925, *Tachysurus liropus* Bristol, 1897, and *Tachysurus steindachneri* Gilbert and Starks, 1904.

The aims of this paper are to describe a new species of *Cathorops* from Mesoamerica; redescribe four valid *Cathorops* species with previous ambiguous statuses; clarify (whenever possible) the valid scientific names and synonyms for the Eastern Pacific species of *Cathorops*; and provide an artificial key to identify the Pacific species of *Cathorops*.

Material and Methods

The present results are based on the analysis of 41 morphometric and six meristic characters. Counts and measurements were taken according to Marceniuk (2007b) and Marceniuk and Betancur-R. (2008). The dorsomedial groove of neurocranium referred to herein is formed by the anterior fleshy portion apposed to the anterior cranial fontanel and limited by the posterior branches of the mesethmoid and frontals (Fig. 2) and a posterior bony portion formed by the mesial depression of the frontals and the anterior portion of supraoccipital (Fig. 3). Usage of "nuchal plate" in text refers to the fusion of the anterior and the medial nuchal plates (Royero, 1987).

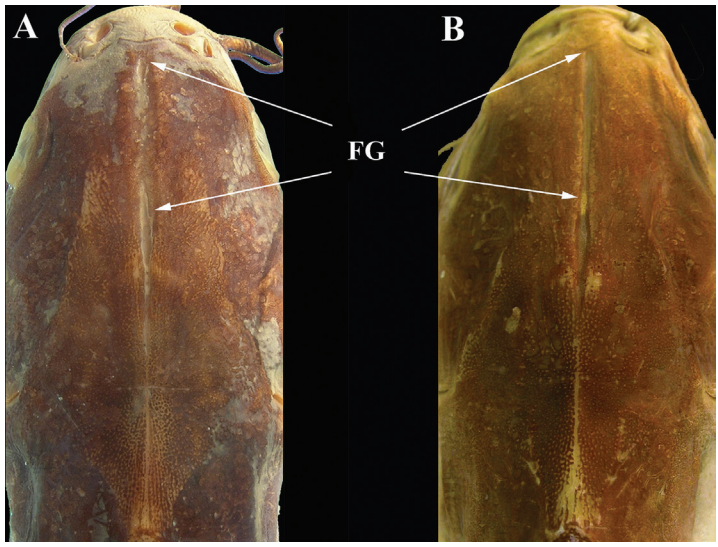

Figure 2. Head in dorsal view showing fleshy dorsomedial groove. (A) *Cathorops manglarensis*, USNM 286392, 164.0 mm SL; (B) *Cathorops steindachneri*, FMNH 32053, 139.0 mm SL.

Measurements are given as percentages of standard length (SL), unless stated otherwise. Individual measurements are given for primary types in tables and meristic values for the type-specimens are indicated in bold. Whenever possible, sex of specimens was determined by examination of the gonad morphology under magnification. Variables in which differences were found between males and females are discussed under the sexual dimorphism section of each species [gonads of *Cathorops liropus, Cathorops steindachneri* (Gilbert and Starks, 1904), and *Cathorops taylori* (Hildebrand) were not examined; see Marceniuk and Betancur-R. (2008) for detailed discussion on sexual dimorphism in *Cathorops*]. Diagnoses of the genus and subgenus *Cathorops* follow Betancur-R. et al. (2007), Marceniuk and Menezes (2007), and Marceniuk and Betancur-R. (2008) (see Appendix I). Diagnoses for each described species are based on characteristics that differentiate consubgeners only so as to avoid unnecessary repetition of characters that diagnose subgenera.

Institutional Abbreviations.—AMNH—American Museum of Natural History, New York, NY; FMNH—Field Museum of Natural History, Chicago, IL; MCZ—Museum of Comparative Zoology, Harvard University, Cambridge, MA; IBUNAM-P—Colección Nacional de Peces, Instituto de Biología de la Universidad de Autónoma de México, Mexico City; ICN-MHN—Instituto de Ciencias Naturales, Museo de Historia Natural, Facultad de Ciencias, Universidad Nacional de Colombia, Bogotá; INVEMAR-PEC—Fish Collection, Museo de Historia Natural Marina de Colombia, Instituto de Investigaciones Marinas y Costeras, Santa Marta, Colombia; STRI—Smithsonian Tropical Research Institute, Balboa, Panama (STRI: tissue collection); SU—Stanford University (currently at California Academy of Sciences, San Francisco, CA); USNM—National Museum of Natural History, Smithsonian Institution, Washington, DC; UAZ—University of Arizona, Tucson, AZ.

Comparative Material Examined.—Cathorops agassizii: All Brazil, MZUSP 25169 (1, 186.0 mm SL), Pará, Vigia; MZUSP 49346 (4, 154.0–157.0 mm SL), Pará, Cajueiro, Mosqueiro island, Marajó bay; MZUSP 49347 (2, 201.0–219.0 mm SL), Pará, fish market of Vigia; MZUSP 37228 (1, 148.0 mm SL), Maranhão, Coqueiro straight, São Luís island; MZUSP 49344 (1, 147.0 mm SL), Maranhão, Curica River, São Luís island; MZUSP 37230 (3, 102.0–148.0 m), Alagoas, Maceió; MZUSP 37231 (3, 76.0–137.0 mm SL), Alagoas, Maceió, Mundaú Lagoon;

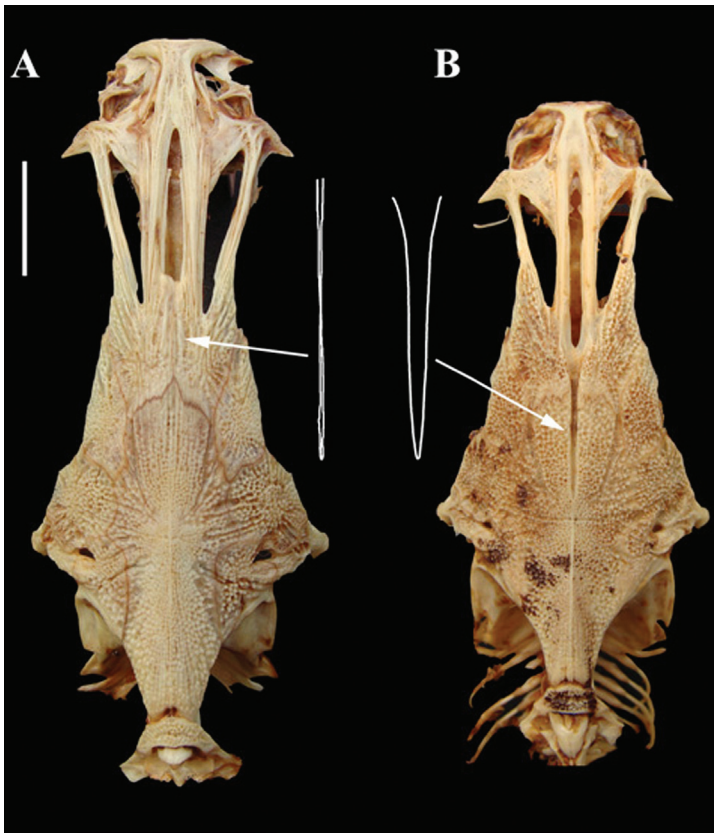

Figure 3. Neurocranium in dorsal view showing the osseous dorsomedial groove. (A) *Cathorops fuerthii*, USNM 79398; (B) *Cathorops manglarensis*, USNM 286392. Scale bar = 10 mm.

MZUSP 37232 (6, 94.0–142.0 mm SL), Alagoas, Maceió, Mundaú Lagoon; MZUSP 37234 (3, 96.0–149.0 mm SL), Alagoas, Maceió, Mundaú Lagoon; MZUSP 37235 (2, 89.0–110.0 mm SL), Alagoas, Maceió, Mundaú Lagoon; MZUSP 49341 (6), Alagoas, Maceió, Mundaú Lagoon; MZUSP 49342 (1), Alagoas, Maceió, Mundaú Lagoon; MZUSP 49343 (2), Alagoas, Maceió, Mundaú Lagoon; MZUSP 51709 (11), Alagoas, Maceió, Mundaú Lagoon; MZUSP 49355 (4), Sergipe, Jarapatuba River, near Pirambú; MZUSP 49356 (4), Sergipe, Jarapatuba River, near Pirambú; MZUSP 37237 (2, 149.0–151.0 mm SL), Sergipe, Sergipe River; MZUSP 49358 (4), Sergipe, Sergipe River; MZUSP 49359 (6), Sergipe, Sergipe River; MZUSP 49354 (1), Sergipe, mouth of Pomongá River, near Aracaju. *Cathorops arenatus*: USNM 233482 (6, 110.0–133.0 mm SL), Venezuela, mouth of Orinoco River, upstream from sea buoy; USNM 66101 (1, 141.0 mm SL), Guyana, Georgetown market; USNM 286395 (3, 92.0–94.0 mm SL), Surinam, 06°04′N 54°51′W; USNM 225446 (3, 101.0–106.0 mm SL), Surinam, Nickerie district, Corantijn River off Clara Creek; MZUSP 37241 (1, 136.0 mm SL), French Guiana, Pointe des Roches; USNM 286461 (1, 126.0 mm SL), French Guiana, 04°59′N 51°58′W; USNM 286465 (1, 130.0 mm SL), French Guiana, 04°43′N 51°29′W; USNM 286750 (2, 142.0–182 mm SL), Brazil, Amapá, 01°04′N 48°06′W; USNM 286458 (1, 190.0 mm SL), Brazil, Amapá, 02°55′N 49°44′W; USNM 286459 (1, 150.0 mm SL), Brazil, Amapá, 03°16′N 50°03′W; USNM 286463 (2, 159.0–169.0 mm SL), Brazil, Amapá, 03°27′N 50°25′W; USNM 286471 (3, 115.0–144.0 mm SL), Brazil, Amapá, 01°26′N 48°14′W; USNM 286472 (4, 117.0–147.0 mm SL), Brazil, Amapá, 00°24′N 47°32′W; USNM 286394 (3, 130.0–158.0 mm SL), Brazil, Amapá, 03°17′N 50°12′W; USNM 286509 (2, 163.0–171.0 mm SL), Brazil, Amapá, 02°16′N 48°47′W; MZUSP 49345 (1, 155.0 mm SL), Brazil, Pará, Marajó Bay; MZUSP 49364 (1, 172.0 mm SL), Brazil, Pará,

fish market of Vigia; MZUSP 48523 (1, 89.0 mm SL), Brazil, Pará, Marajó Bay, Jubim. *Cathorops dasycephalus*: USNM 286481 (3, 131.0–166.0 mm SL), Colombia, off Cape Manglares, south of Tumaco; FMNH 19143 (2, 176.0–196.0 mm SL), Panama, Panama Bay, Balboa, Canal Zone. *Arius festae*: (Holotype) MZUT 1479 (1, 187.0 mm SL), Ecuador, Guayas River basin, Naranjal (only photographs examined directly; meristic and morphometric data collected by F. Andreone, Museo Regionale di Scienze Naturali, 2004). *Cathorops hypophthalmus*: USNM 293275 (2, 168.0–185.0 mm SL), Panama, Province of Darién, Pirre River, ~0.5 km above El Real. *Cathorops manglarensis*: All Colombia, (Holotype) USNM 286392 (1, 164.0 mm SL), off Cape Manglares, south of Tumaco; (Paratypes) USNM 388316 (3, 164.0–195.0 mm SL), collected with holotype; USNM 286388 (2, 195.0–195.0 mm SL), San Juan del Sur, off Boca San Juan; USNM 286389 (2, 89.0–107.0 mm SL), off Boca San Juan, north of Tumaco. *Cathorops mapale* species group: All Colombia, (Holotype) INVEMAR-PEC 5333 (1, 183.5 mm SL), Magdalena, Ciénaga Grande de Santa Marta; (Paratypes) ICN-MHN 8244 (1, 166.0 mm SL), Magdalena, Ciénaga Grande de Santa Marta; INVEMAR-PEC 277 (1, 256.0 mm SL), Magdalena, Tasajera; INVEMAR-PEC 1584 (1, 166.0 mm SL), Costa Verde, Magdalena, Ciénaga Grande de Santa Marta; INVEMAR-PEC 5733 (26, 110.0–144.0 mm SL), Magdalena, Salamanca Gulf; INVEMAR-PEC 3654 (1, 180.0 mm SL), Córdoba, Ciénaga de Soledad; INVEMAR-PEC 5197 (1, 156.0 mm SL), Córdoba, mouth of Tinajones River; ICN-MHN 8246 (2, 165.0–179.0 mm SL), Córdoba, mouth of Sinú River; INVEMAR-PEC 5501 (2, 151.0–152.0 mm SL), Antioquia, Urabá Gulf; INVEMAR-PEC 5732 (1, 157.0 mm SL), Antioquia, Urabá Gulf; INVEMAR-PEC 5731 (2, 139.0–172.0 mm SL), Antioquia, Urabá Gulf; INVEMAR-PEC 5348 (1, 118.0 mm SL), Antioquia, Atrato River, mouth of El Roto, Urabá Gulf; ICN-MHN 8247 (1, 143.0 mm SL), Antioquia, Atrato River, mouth of El Roto, Urabá Gulf. *Cathorops multiradiatus*: (Neotype) USNM 79408 (1, 192.0 mm SL), Panama Bay, Balboa; (Non Type specimens) USNM 388315 (1, 209.0 mm SL), collected with neotype; USNM 292703 (1, 174.0 mm SL), Colombia, about 1.5 hrs. by motor boat north of Buenaventura; sandy beach immediately south of Punta Canchaco in Ensenada de Juanchaco; USNM 286400 (2, 120.0–125.0 mm SL), Colombia, off Cape Manglares, south of Tumaco. *Cathorops spixii*: USNM 286461 (1, 126.0 mm SL), French Guiana, 04°59´N–51°58´W; MZUSP 37214 (1, 64.0 mm SL), Brazil, Pará, Vigia; MZUSP 49345 (6), Brazil, Pará, Marajó bay; MZUSP 49411 (2), Brazil, Pará, Coroinha, Marajó Bay; MZUSP 49348 (1), Brazil, Pará, Maguari, Marajó Bay; MZUSP 37215 (2, 88.0–91.0 mm SL), Brazil, Maranhão, Pajé, Coqueiro Strait, São Luís Island; MZUSP 49350 (1), Brazil, Paraíba, Lucena; MZUSP 49351 (1), Brazil, Paraíba, Lucena; MZUSP 49349 (1), Brazil, Paraíba, Lucena; MZUSP 37236 (3, 95.0–161.0 mm SL), Brazil, Sergipe, Sergipe River; MZUSP 49363 (16), Brazil, Sergipe, Sergipe River; MZUSP 49357 (2), Brazil, Sergipe, Japaratuba River, near Pirambú; MZUSP 24374 (2, 106.0–106.0 mm SL), Brazil, Bahia, mouth of Paraguassú River, near Maragogipe; MZUSP 2300 (2, 189.0–192.0 mm SL), Brazil, Espírito Santos, Paraíba River, São João da Barra; MZUSP 49353 (7, 101.0–133.0 mm SL), Brazil, Rio de Janeiro, Pontal de Atafona; MZUSP 24487 (4, 95.0–120.0 mm SL), Brazil, Rio de Janeiro, Macaé, Portinha; MZUSP 22783 (1, 121.0 mm SL), Brazil, Rio de Janeiro, Maricá Lagoon; MZUSP 48526 (2, 166.0–181.0 mm SL,), Brazil, Rio de Janeiro, Sepetiba Bay. *Cathorops tuyra*: All Panama, USNM 286466 (6, 138.0–225.0 mm SL), Pirre River, 3–5 mi (4.83–8.05 km) above El Real; USNM 292824 (2, 149.0–165.0 mm SL), Uruseca River, 2 mi (3.22 km) above El Real; USNM 286462 (1, 146.0 mm SL), Uruseca River, 2 mi (3.22 km) above El Real; USNM 286397 (1, 123.0 mm SL), Pirre River, 3–5 mi (4.83–8.05 km) above El Real; STRI-5773 (1, 265.0 mm SL), Punta Chame.

Results

Cathorops (Cathorops) fuerthii (Steindachner, 1877)

Congo sea catfish or bagre congo (Spanish)

(Figs. 4A,5A; Tables 1–4)

Arius fuerthii Steindachner, 1877: 579 [Syntypes: MCZ 4943 (2), MCZ 4973 (3), MCZ 7691 (1), NMW 50568 (2)]. Type-locality: Pacific Panama. Originally spelled *Fürthii*.—Jordan and Gilbert, 1882: 39 and 52 (Panama; spelled *furthii*); Regan, 1907: 127, PL. XVIII, fig. 2, and PL. XIX, fig. 8 (Panama); Meek and Hildebrand, 1923: 125 (Balboa and Panama City market; spelled *fürthii*); Burgess 1989: 168 (spelled *furthi*).

Galeichthys fuerthii (Steindachner).—Jordan, 1885: 366 (Panama; spelled *furthi*).

Tachisurus fuerthii (Steindachner).—Eigenmann and Eigenmann, 1888: 146 (Panama; spelled *furthii*); Eigenmann and Eigenmann, 1890: 90–92 (Panama; spelled *fürthii*),

Tachysurus fuerthii (Steindachner).—Jordan and Evermann, 1896: 132, 1898 and 2787 (Panama; spelled *furthii*); Gilbert and Starks, 1904: 32 (Panama Bay; spelled *fürthii*).

Tachysurus evermanni Gilbert and Starks 1904: 32, Pl. 5 (fig. 10) (Holotype: SU 6706. Type-locality: Panama Bay, eastern Pacific).

Arius evermanni (Gilbert and Starks).—Regan, 1907: 127, PL (Panama).

Cathorops fuerthii (Steindachner).—Allen and Robertson, 1994: 68 (spelled *furthii*); Bussing and López, 1994: 58 (in part); Kailola and Bussing, 1995: 880 (Mexico to Colombia, in part); Marceniuk and Ferraris, 2003:449 (Mexico to Ecuador; in part); Nelson et al., 2004: 83 (in part); Kailola, 2004: 132; Betancur-R. and Acero P., 2005: 54; Miller et al., 2005: 171 (in part); Ferraris, 2007: 39–40 (Mexico to Ecuador; in part); Marceniuk, 2007a: 46 (Panama); Marceniuk and Menezes, 2007: 44 (Mexico to Ecuador; in part); Robertson and Allen, 2008 (Guatemala to Peru; in part).

Diagnosis.—*Cathorops fuerthii* can be distinguished from its consubgeners from the Eastern Pacific by having an osseous dorsomedial groove of neurocranium inconspicuous and remarkably shallow, with irregular margins parallel along its entire extension (Fig. 3A) (vs dorsomedial groove of neurocranium conspicuous and deep, with straight margins tapering posteriorly in all other species; Fig. 3B), caudal-fin lobes wide and rounded posteriorly (Fig. 4A) (vs caudal-fin lobes narrow and pointed posteriorly in *C. hypophthalmus*, *C. liropus*, *C. steindachneri*, *C. taylori*, and *C. tuyra*; Fig. 4D,E), and dorsal-fin spine remarkably thinner than pectoral-fin spine (Fig. 4A) (vs dorsal-fin spine thicker or as thick as pectoral-fin spine in *C. hypophthalmus*, *C. liropus*, *C. multiradiatus*, *C. steindachneri*, *C. taylori*, and *C. tuyra*; Fig. 4B,E).

Cathorops fuerthii is further distinguished from *C. hypophthalmus* by having the eye dorsal to the angle of mouth (vs at the same level or ventral to the angle of mouth), 14–17 gill rakers on first arch (vs 37–40), shorter distance between snout and posterior margin of osseous dorsomedial groove of neurocranium (21.6%–28.3% SL vs 31.4%–34.1% SL), shorter dorsal-fin spine (18.4%–20.4% SL vs 25.0%–25.2% SL), and shorter caudal-fin lower lobe (28.6%–29.9% SL vs 30.3%–33.5% SL); from *C. liropus* by having a smaller orbital diameter (3.2%–4.2% SL vs 5.0%–6.4% SL; Fig. 6A); from *C. multiradiatus* by having 22–24 anal-fin rays (vs 25–27), and longer distance between posterior nostrils (5.8%–7.3% SL vs 5.1%–5.8% SL); from *Cathorops raredonae* by possessing a longer distance between snout and maxillary barbel (2.3%–3.2% SL vs 1.3%–2.2% SL), and relatively longer supraoccipital process (10.4%–11.9% SL vs 8.7%–10.5% SL); from *C. steindachneri* by having a fleshy portion of dorsomedial groove of neurocranium inconspicuous, wide and shallow (Fig. 5A) (vs fleshy portion of dorsomedial groove conspicuous, narrow and deep; Fig. 2B), smaller orbital diameter (3.2%–4.2% SL vs 4.7%–5.3% SL; Fig. 6A), and longer distance between posterior nostrils (5.8%–7.3% SL vs 4.5%–5.3% SL); from *C. taylori* by having a smaller orbital diameter (3.2%–4.2% SL vs 4.6%–5.7% SL; Fig. 6A); and from *C. tuyra* by having 22–24 anal-fin rays (vs 19–20), 14–17 gill rakers on first arch (vs 19–22), thin lips (vs

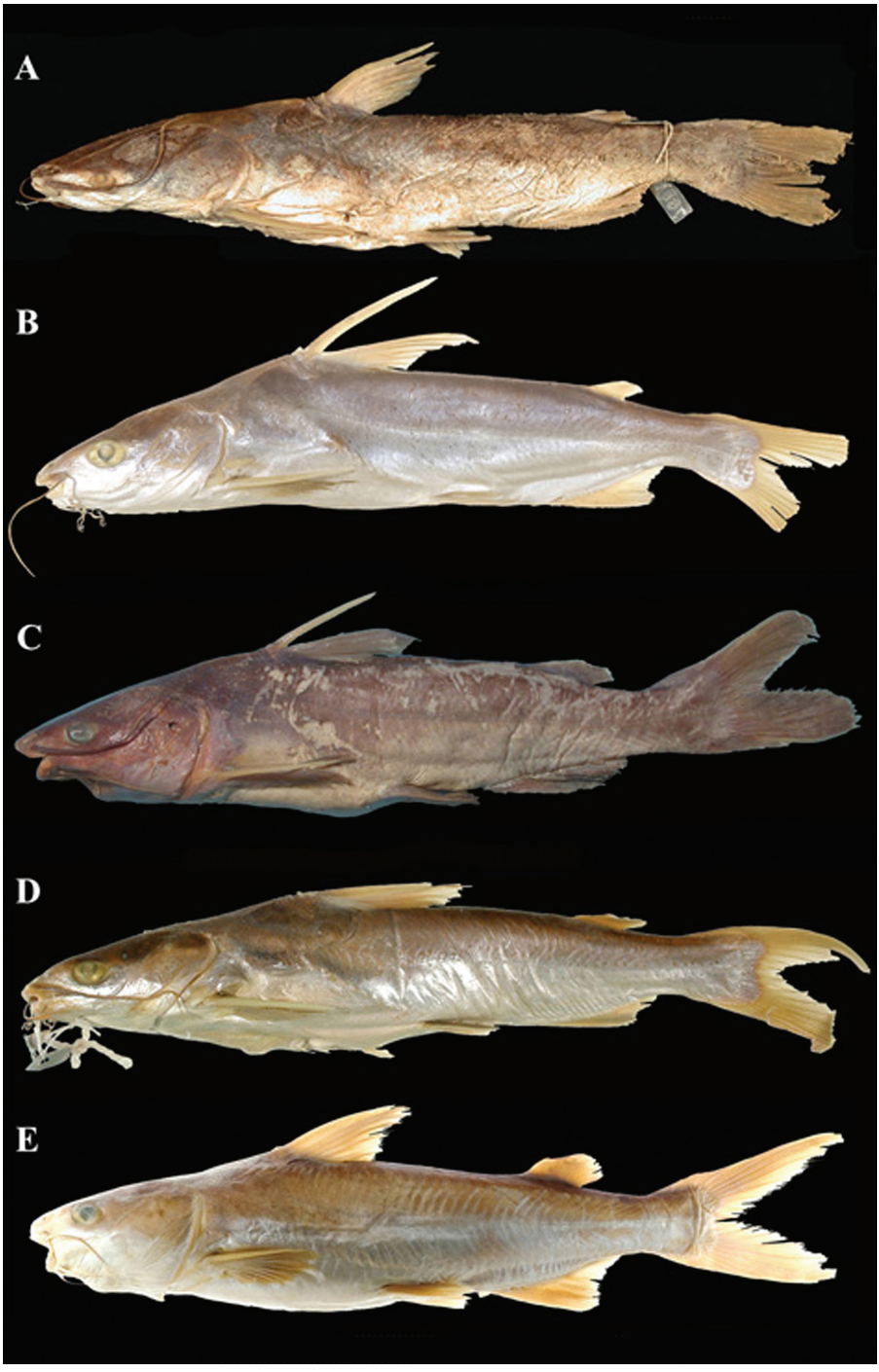

Figure 4. Body in lateral view. (A) *Cathorops fuerthii*, syntype, MCZ 7691, 243.0 mm SL; (B) *Cathorops liropus*, syntype, USNM 47584, 197.0; (C) *Cathorops raredonae*, holotype, USNM 286464, 178.0 mm SL; (D) *Cathorops steindachneri*, holotype, SU 7026, 168.8 mm SL; (E) *Cathorops taylori*, holotype, USNM 87224, 283.0 mm SL.

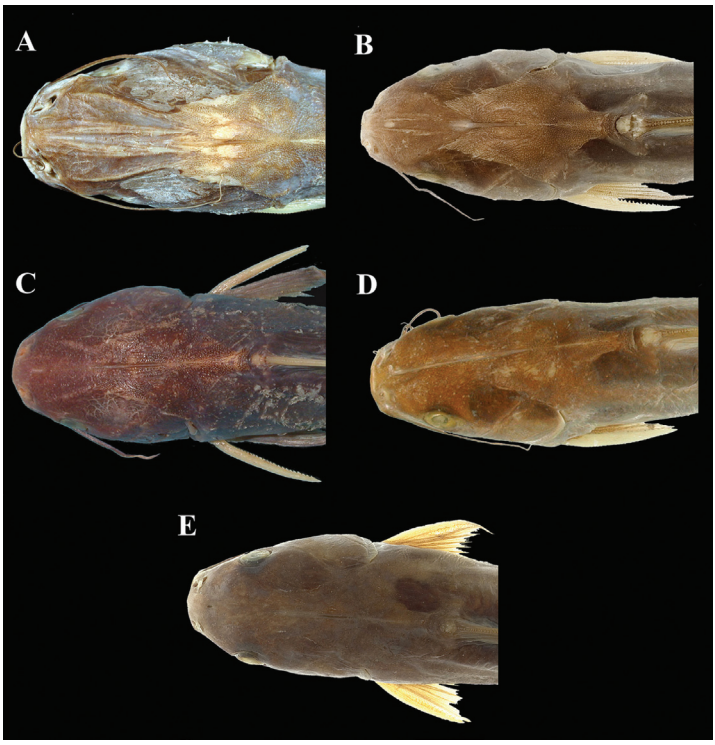

Figure 5. Head in dorsal view. (A) *Cathorops fuerthii*, syntype, MCZ 7691, 243.0 mm SL; (B) *Cathorops liropus*, syntype, USNM 47584, 197.0; (C) *Cathorops raredonae*, holotype, USNM 286464, 178.0 mm SL; (D) *Cathorops steindachneri*, holotype, SU 7026, 168.8 mm SL; (E) *Cathorops taylori*, holotype, USNM 87224, 283.0 mm SL.

lips quite thick), and accessory tooth plates and posterior expansion of dentary with small molariform teeth (vs with large molariform teeth).

Cathorops fuerthii may be also distinguished from its closely related consubgeners from the Atlantic and Caribbean coasts of South America (see Phylogenetic Relationships below) by having an osseous dorsomedial groove of neurocranium inconspicuous and remarkably shallow, with irregular margins parallel along its entire extension (Fig. 3A) (vs dorsomedial groove of neurocranium conspicuous and deep,

Table 1. Meristic frequencies of anal-fin rays in species of the subgenus *Cathorops* from the Eastern Pacific. Bolded numbers indicate counts for primary types.

Anal-fin rays	19	20	21	22	23	24	25	26	27
C. fuerthii				2	**6**	2			
C. hypophthalmus				1	1				
C. liropus		2	**4**	2	**1**				
C. manglarensis						1	2	3	**2**
C. multiradiatus							1	2	**2**
C. raredonae	2	2	**2**	5	3				
C. steindachneri		2	**1**	5	2				
C. taylori		3	4	3	**1**				
C. tuyra	4	6							

Table 2. Meristic frequencies of gill rakers on first arch in species of the subgenus *Cathorops* from the Eastern Pacific. Bolded numbers indicate counts for primary types.

Gill rakers on first arch	13	14	15	16	17	18	19	20	21	22	37	40
C. fuerthii		2	**4**	3	2							
C. hypophthalmus											1	1
C. liropus				**3**	**4**	3	2					
C. manglarensis	2	3	**2**	1								
C. multiradiatus				1	1	2	**1**					
C. raredonae	**5**	5	3									
C. steindachneri			1	**5**	1							
C. taylori				1	**6**	2						
C. tuyra							2	3	3	2		

with straight margins tapering posteriorly in *C. agassizii*, *C. arenatus*, *C. mapale* group, and *C. spixii*).

Description.—(Counts of anal fin rays and gill rakers on first and second arches given in Tables 1–3; morphometric data given in Table 4). Head relatively long and depressed, profile slightly elevated posteriorly, convex at frontal and supraoccipital areas. Snout moderately long and rounded transversely. Anterior nostril rounded, with fleshy edge, posterior nostril covered by flap of skin; nostrils relatively separated to one another and distant from orbit, not connected by fleshy furrow. Eye lateral and small; eyes widely separated to one another. Three pairs of teretiforme barbels; maxillary barbel surpassing base of pectoral-fin spine, lateral mental barbel surpassing margin of gill membrane, mesial mental barbel reaching margin of gill membrane. Osseous bridge formed by lateral ethmoid and frontal long and slender, quite evident under skin. Cephalic shield exposed, rough and granulated, quite evident on postorbital region; shield long and wide on lateral ethmoid, frontal, and epioccipital areas, relatively narrow on supracleithrum area. Anterior portion of dorsomedial groove of neurocranium fleshy, wide and shallow, inconspicuous and continuous to level of anterior nares; posterior portion of groove osseous, shallow and inconspicuous, with irregular and parallel margins. Supraoccipital process funnel-shaped, long and wide on posterior portion. Nuchal plate crescent-shaped, moderately long and wide.

Mouth subterminal to terminal, relatively large; lower jaw slightly arched. Lips thin, lower lip thinner than upper lip. Vomerine tooth plates absent. One pair of

Table 3. Meristic frequencies of gill rakers on second arch in species of the subgenus *Cathorops* from the Eastern Pacific. Bolded numbers indicate counts for primary types.

Gill rakers on second arch	13	14	15	16	17	18	19	20	37	40
C. fuerthii			5	**6**	**3**					
C. hypophthalmus									1	1
C. liropus					**6**	**4**	1	1		
C. manglarensis				4	**3**	1				
C. multiradiatus			1	1	**2**	1				
C. raredonae	3	1	**4**	1						
C. steindachneri				1	**2**					
C. taylori			1	**1**	2					
C. tuyra			1	1	3	4	3	1		

Table 4. Morphometric data for *Cathorops fuerthii* and *Cathorops liropus*. Standard length is expressed in millimeters, all other measurements are expressed in percents of standard length.

	Cathorops fuerthii				*Cathorops liropus*			
	Syntypes	N	Mean	Range	Syntypes	N	Mean	Range
Standard length (mm)	196.0–243.0	10		185.0–332.0	140.0–197.0	18		83.0–231.0
Head length	26.1–30.5	10	28.4	24.9–32.5	25.7–28.4	8	25.0	23.2–28.4
Snout length	6.8–8.2	8	7.4	6.3–8.2		10	7.7	5.4–9.7
Distance between anterior nostrils	4.4–5.7	10	5.4	4.4–6.0	3.0	7	4.1	3.0–4.6
Distance between posterior nostrils	6.2–6.7	8	6.4	5.8–7.3	4.0–4.8	8	5.3	4.0–6.5
Distance between anterior nostril and orbit	5.9–6.4	8	6.6	5.9–7.4		4	6.5	5.9–6.9
Distance between posterior nostril and orbit	3.9–4.5	8	4.6	3.9–5.5		4	4.5	4.1–4.8
Orbital diameter	3.8–4.2	10	3.8	3.2–4.2	5.6–5.7	14	5.7	5.0–6.4
Interorbital distance	13.1–13.9	10	14.2	13.1–15.7	10.9–11.8	8	12.6	10.9–13.8
Maxillary barbel length	26.7–32.1	10	28.6	25.6–31.1	22.4–26.6	8	29.8	22.4–34.4
Lateral mental barbel length	15.2–21.8	9	18.9	15.2–22.8	12.1–18.1	8	20.0	12.1–24.1
Mesial mental barbel length	11.7–15.0	10	12.6	10.3–15.0	10.5–12.9	8	12.9	9.2–15.3
Mouth width	10.6–11.4	10	10.6	9.1–11.6	8.8	7	9.2	8.6–11.0
Width of cephalic shield at lateral ethmoid area	13.1–13.9	8	13.5	12.6–15.4		4	12.4	11.9–12.7
Width of cephalic shield at frontals area	6.1–6.9	8	6.8	5.9–8.8	6.9–7.2	12	7.1	6.1–8.6
Width of cephalic shield at epioccipital area		5	12.3	11.8–12.9		4	12.4	12.1–12.7
Width of cephalic shield at supracleithrum area	18.5–18.9	8	18.4	17.5–19.2		4	18.7	18.3–19.3
Distance between lateral ethmoid and supracleithrum	21.5–23.7	8	22.5	21.5–28.8		4	20.2	20.0–20.5
Distance between snout and post. margin of dorsomedial groove of neurocranium	23.9–28.3	8	24.6	21.6–28.3	22.9–25.9	16	23.6	16.8–27.2
Supraoccipital process length	10.4–11.5	8	11.3	10.4–11.9	11.7–13.9	12	11.8	10.9–13.9
Supraoccipital process width	2.9–3.3	10	3.1	2.7–3.5	2.8–3.2	4	3.1	2.8–3.3
Nuchal–plate length	6.3–6.8	8	6.6	5.9–7.2	6.5–6.6	9	6.8	6.3–7.4
Nuchal–plate width	6.9–7.5	8	7.2	6.9–7.6		4	7.4	6.9–7.3
Body depth	17.0–18.6	8	18.2	17.0–19.1		4	18.7	18.3–19.3
Body width	21.0–21.1	10	21.3	20.3–23.7	18.6–19.9	8	20.5	18.6–21.7
Distance from snout to maxillary barbel		5	2.7	2.3–3.2		4	1.8	1.2–2.3

Table 4. Continued.

	Cathorops fuerthii				*Cathorops liropus*			
	Syntypes	N	Mean	Range	Syntypes	N	Mean	Range
Distance from snout to pectoral fin	21.3–23.5	10	24.0	21.3–28.0	22.1–24.4	8	22.6	20.8–26.4
Distance from snout to dorsal fin	36.2–40.3	10	39.1	34.9–43.5	38.5–38.6	8	34.5	31.8–38.6
Distance from snout to pelvic fin	49.4–51.7	10	51.1	49.4–53.9	53.6–53.8	8	51.7	48.7–54.0
Distance from snout to adipose fin	75.0–76.9	10	75.4	74.6–76.9	72.1–76.1	7	73.6	70.6–76.1
Distance from snout to anal fin	67.5–69.4	10	67.8	63.9–71.1	66.4–68.0	8	66.1	63.6–68.0
Caudal–peduncle height	8.2–9.3	9	8.6	7.7–9.3	7.4–7.9	8	7.8	6.3–8.6
Pectoral–fin spine length	20.2–20.4	9	20.0	18.1–21.0		10	18.0	15.6–20.4
Dorsal–fin spine length	18.8–18.8	9	19.2	18.4–20.4	22.2	16	21.6	18.3–24.5
Pelvic–fin base length	4.0–4.4	10	4.1	3.5–4.8	2.4–2.8	8	3.7	2.4–4.4
Pelvic–fin height	12.4–16.7	10	14.3	12.4–16.7	12.9–13.4	8	14.7	12.9–20.0
Adipose–fin base length	6.0–6.9	10	7.3	6.0–8.8		4	6.8	5.5–9.0
Adipose–fin height	2.9–3.4	8	3.6	2.9–4.1		4	3.8	2.9–4.6
Anal–fin base length	14.7–18.2	10	17.7	14.7–19.4	15.3–15.5	8	17.2	14.9–20.0
Anal–fin height	17.6–18.4	8	15.5	11.8–18.4		4	15.0	13.5–16.7
Caudal–fin upper lobe length	28.3–29.0	4	29.7	28.3–30.7		11	34.5	30.6–40.0
Caudal–fin lower lobe length		2	29.3	28.6–29.9		13	30.6	28.0–35.8

large oval-shaped accessory tooth plates, slightly separated from one another on anterior portion, with large molariform teeth. Premaxilla relatively long and narrow, with sharp teeth, sometimes fused at symphysis. Dentary separated at midline, with pronounced posterior expansion and sharp teeth on anterior portion, molariform teeth on posterior portion, and few conical teeth in between. Gill membranes fused, attached to isthmus. Fourteen to seventeen acicular gill rakers on first arch, 15–17 spike shaped gill rakers on second arch. Mesial surfaces of all gill arches with developed gill rakers, lateral and mesial surfaces of first and second gill arches lacking fleshy papillae intercalated with gill rakers.

Body width greater than body depth at pectoral girdle area, progressively more compressed from pectoral fin to caudal peduncle. Lateral line sloping ventrally on anterior one-third, extending posteriorly to caudal peduncle, bending abruptly onto dorsal lobe of caudal fin. Dorsal-fin spine short and quite thin, remarkably thinner than pectoral-fin spine; anterior margin with granules on proximal two thirds, distal one-third with short serrations; posterior margin serrated along almost entire length. Seven dorsal-fin soft rays. Pectoral-fin spine short and thick; anterior margin with granules on basal two thirds, distal one-third with short serrations; posterior margin smooth on basal one-fourth, distal three-fourths with short serrations. Nine or ten pectoral-fin soft rays. Posterior cleithral process exposed, smooth and triangular shaped, short and pointed posteriorly. Pelvic fin deep and moderately long at base, with six rays. Adipose-fin base relatively short, less than one-half the length of anal-fin base, anterior origin at level of anterior half of anal fin. Anal fin relatively deep and long at base, with 22–24 rays and distal margin slightly concave. Caudal peduncle deep. Caudal fin forked, upper and lower lobes short, posteriorly rounded; upper lobe longer than lower lobe.

Coloration.—In life, dark blue or brownish on dorsum, silvery white on sides and venter; fins dusky; skin often peeling. In alcohol, brownish on dorsal and lateral portions, progressively lighter towards lateral line, light beige to whitish ventrally, with scattered dusky dots. Maxillary barbel brownish, mental barbel lighter; adipose fin dark, other fins darker than venter; pelvic fins with small dark dots.

Sexual Dimorphism.—Sexual dimorphism was observed in three females (200.0–242.0 mm SL) and four males (185.0–332.0 mm SL). Males have longer head than females, as evidenced by greater head length (26.5%–32.5% SL vs 24.9%–27.2% SL), greater distance between lateral ethmoid and supracleithrum (23.2%–28.8% SL vs 22.5%–23.2% SL), greater distance between anterior nostril and orbit (6.9%–7.4% SL vs 6.3%–6.7% SL), and greater distance between posterior nostril and orbit (5.0%–5.5% SL vs 4.5%–4.7% SL). Females have longer mesial mental barbel (10.8%–12.9% SL vs 10.3%–10.9% SL) and lateral mental barbel (17.7%–19.7% SL vs 15.9%–17.6% SL) than males. Posterior nostrils more separated in males than in females (6.2%–7.3% SL vs 5.8%–6.4% SL). Supraoccipital process broader on posterior portion in females than in males (3.2%–3.3% SL vs 2.7%–3.0% SL). Premaxilla broader in males than in females (6.5%–7.7% SL vs 5.6%–6.2% SL); accessory tooth plates longer (4.3%–4.9% SL vs 3.9%–4.2% SL) and broader (2.1%–2.2% SL vs 1.6%–2.0% SL) in females than in males (Fig. 7). Accessory tooth plates in males containing fewer and smaller molariform teeth (Fig. 7). Posterior expansion of dentary longer and with more molariform teeth in females (Fig. 7). Spawning males with accessory tooth plates covered by epithelial tissue. Females with longer pelvic fin (15.1%–16.6% SL vs 12.5%–12.8% SL),

and deeper anal (14.6%–15.2% SL vs 11.8%–13.4% SL) and adipose fins (3.9%–4.1% SL vs 3.6%–3.8% SL) than males.

Distribution and Habitat.—*Cathorops fuerthii* has been widely recorded from its type locality (Panama Bay); however, Allen and Robertson (1994), Kailola and Bussing (1995), and later authors extended the distribution as far north as the Gulf of California and southwards to Peru. It is noteworthy that exhaustive collections in the Colombian Pacific by AAP and RBR during the last decade have yielded no material of *C. fuerthii*; thus, its presence farther south is unlikely. Similarly, museum and literature records from Mexico to El Salvador represent other species discussed below (e.g., *C. liropus* from Mexico, *C. raredonae* from Mexico to El Salvador). The material examined of *C. fuerthii* is from Panama Bay; it may extend northwestwards to Costa Rica (Bussing and López, 1994). Inhabits shallow marine and estuarine waters (Fig. 8).

Size.—Largest specimen examined is 332.0 mm SL (STRI 5720). It is one of the largest species of *Cathorops*.

Phylogenetic Relationships.—Betancur-R. et al. (2007) inferred relationships for 13 species of *Cathorops* using Bayesian inference and maximum parsimony criteria on mitochondrial sequences (Fig. 1). According to their hypothesis, *C. fuerthii* is sister to *C. raredonae*, and that clade is sister to the *C. mapale* species group from the southern Caribbean. This transisthmian group is also closely related to a clade including *C. agassizii* and *C. spixii* (and possibly *C. arenatus*) from the Western Atlantic in South America.

Remarks.—*Tachysurus evermanni* was described by Gilbert and Starks (1904), based on a specimen collected in Panama Bay. Although the species was validated by Regan (1907), contemporary authors have listed it within the synonymy of *C. fuerthii* (Kailola and Bussing, 1995; Marceniuk and Ferraris, 2003; Ferraris, 2007; Marceniuk and Menezes, 2007). Our examination of the holotype of *T. evermanni* confirms that it is conspecific with *C. fuerthii* based on the following features: dorsal spine thinner than pectoral spine, caudal-fin lobes wide and rounded, orbital diameter 4.1%SL (3.2%–4.2% SL in *C. fuerthii*), 23 anal-fin rays (22–24 in *C. fuerthii*), and 17 anterior gill rakers on first arch (14–17 in *C. fuerthii*).

Material Examined.—All Panama. Syntypes of *Arius fuerthii*: MCZ 4943 (1, 207.0 mm SL); MCZ 7691 (1, 243.0 mm SL); MCZ 4973 (1, 196.0 mm SL). Holotype of *Tachysurus evermanni*, SU 6706 (208.0 mm SL), Panama Bay. Non-types: USNM 79398 (5, 199.0–260.0 mm SL), Panama Bay, Balboa, Canal Zone; STRI 5720 (STRI-17564 and STRI-17563) (2, 321.0–332.0 mm SL), Punta Patiño.

Cathorops (Cathorops) liropus (Bristol, 1897)

Conguito sea catfish or bagre conguito (Spanish)

(Figs. 4B, 5B; Tables 1–4)

Arius melanopus non-Günther.—Jordan and Evermann, 1896: 132 (Ahome River, west coast of Mexico, above Mazatlán).

Tachysurus liropus Bristol in Gilbert, 1897: 438 [Type-locality: San Juan Lagoon, near mouth of Ahome River, Sonora, Mexico, Syntypes: SU 324 (3); USNM 47584 (2)].—Jordan and Evermann, 1895: 231 (nomem nudum) (San Juan Lagoon, Ahome River, Sonora); Jordan and Evermann, 1898: 2784 (descripition; San Juan Lagoon and Ahome River, Sonora); Marce-

niuk and Ferraris, 2003: 450 (species inquirendae in *Cathorops*); Ferraris, 2007: 41 (species inquirendae in *Cathorops*).

Arius liropus (Bristol).—Regan, 1907: 127 (Mexico, San Juan Lagoon, Sonora); Burgess, 1989: 169.

Cathorops fuerthii (non Steindachner).—Allen and Robertson, 1994 (Mexico to Peru, in part); Kailola and Bussing, 1995: 880 (Mexico to Colombia, in part); De La Cruz Agüero et al., 1997: 59; Castro-Aguirre et al., 1999: 146 (San Juan Lagoon and Ahome River, Sonora to Mar Muerto, Chiapas; spelled *fuerthi*, in part); Kailola, 2004: 126 (in part); Miller et al., 2005: 171; Marceniuk and Menezes, 2007: 44 (Mexico to Ecuador; in part).

Diagnosis.—*Cathorops liropus* can be distinguished from its consubgeners from the Eastern Pacific by the presence of caudal-fin lobes narrow and pointed posteriorly (vs caudal-fin lobes wide and rounded posteriorly in *C. fuerthii*, *C. manglarensis*, *C. multiradiatus*, and *C. raredonae*; Fig. 4A,C), dorsal-fin spine thicker than pectoral-fin spine (Fig. 4B) (vs dorsal-fin spine remarkably thinner than pectoral-fin spine in *C. fuerthii*, *C. manglarensis*, and *C. raredonae*; Fig. 4A,C), orbital diameter 5.0%–6.4% SL (vs 3.2%–4.2% SL in *C. fuerthii*, 3.0%–3.5% SL in *C. hypophthalmus*, 3.7%–4.8% SL in *C. manglarensis*, and 3.5%–4.2% SL in *C. raredonae*; Fig. 6A), supraoccipital process length 10.9%–13.9% SL (vs 9.4%–10.6% SL in *C. taylori,* and 8.7%–10.5% SL in *C. raredonae*; Fig. 6B), width of cephalic shield at frontal area 6.1%–8.6% SL (vs 5.5% SL in *C. steindachneri*, and 5.2%–6.1% SL in *C. tuyra*).

Cathorops liropus is further distinguished from *C. fuerthii* by having an osseous dorsomedial groove of neurocranium conspicuous and deep, with straight margins that taper posteriorly (Fig. 5B) (vs osseous dorsomedial groove of neurocranium inconspicuous and remarkably shallow, with irregular margins parallel along its entire length; Fig. 3A); from *C. hypophthalmus* by having the eye dorsal to the angle of mouth (vs at the same level or ventral to the angle of mouth), 16–19 gill rakers on first arch (vs 37–40); from *C. raredonae* by having 16–19 gill rakers on first arch (vs 13–15); from *C. manglarensis* by having 20–23 anal-fin rays (vs 24–27); from *C. multiradiatus* by possessing 20–23 anal-fin rays (vs 25–27); from *C. steindachneri* by having a fleshy portion of dorsomedial groove of neurocranium inconspicuous, wide and shallow (Fig. 5B) (vs fleshy groove conspicuous, narrow and deep; Fig. 2B); from *C. taylori* by having nuchal plate length 0.82–0.96 in width of cephalic shield at frontal area (vs 0.97–1.3); and from *C. tuyra* by having thin lips (vs lips quite thick), and accessory tooth plates and posterior expansion of dentary with small molariform teeth (vs with large molariform teeth).

Description.—(Counts of anal fin rays and gill rakers on first and second arches given in Tables 1–3; morphometric data given in Table 4). Head short and depressed, profile quite elevated posteriorly and straight at frontal and supraoccipital areas. Snout moderately long and rounded transversely. Anterior nostril rounded, with fleshy edge, posterior nostril covered by flap of skin; nostrils moderately separated to one another and close from orbit, not connected by fleshy furrow. Eye lateral and large; eyes relatively close to one another. Three pair of teretiforme barbels; maxillary barbel surpassing base of pectoral-fin spine, lateral mental barbel surpassing margin of gill membrane, mesial mental barbel reaching or falling short of margin of gill membrane. Osseous bridge formed by lateral ethmoid and frontal long and slender, evident under skin. Cephalic shield exposed, rough, and granulated, quite evident on postorbital region; shield short and wide on frontal, supracleithrum, and epioccipital areas, relatively narrow on lateral ethmoid area. Anterior portion of

dorsomedial groove of neurocranium fleshy, wide and shallow, inconspicuous, and not continuous to level of anterior nares; posterior portion of groove osseous, deep and conspicuous, with straight margins tapering posteriorly. Supraoccipital process funnel-shaped, relatively long and wide on posterior portion. Nuchal plate crescent-shaped, long and wide.

Mouth subterminal to terminal, relatively large; lower jaw arched. Lips thin, lower lip thinner than upper lip. Vomerine tooth plates absent. One pair of oval shaped accessory tooth plates, variable in size, slightly separated from one another on anterior portion, with molariform teeth. Premaxilla relatively long and narrow, with sharp teeth, sometimes fused at symphysis. Dentary separated at midline, with pronounced posterior expansion and sharp teeth on anterior portion, molariform teeth on posterior portion, and some conical teeth in between. Gill membranes fused, attached to isthmus. Sixteen to nineteen acicular gill rakers on first arch, 17–19 spike shaped gill rakers on second arch. Mesial surfaces of all gill arches with developed gill rakers, lateral and mesial surfaces of first and second gill lacking fleshy papillae intercalated with gill rakers.

Body width greater than body depth at pectoral girdle area, progressively more compressed from pectoral fin to caudal peduncle. Lateral line sloping ventrally on anterior one-third, extending posteriorly to caudal peduncle, bending abruptly onto dorsal lobe of caudal fin. Dorsal-fin spine quite long and thick, thicker than pectoral-fin spine; anterior margin with granules on basal one-third, distal two-thirds with short serrations; posterior margin with short and inconspicuous serrations along almost its entire length. Seven dorsal-fin soft rays. Pectoral-fin spine long and thick; anterior margin granulated along almost its entire length, posterior margin with relatively long and conspicuous serrations. Ten or eleven pectoral-fin soft rays. Posterior cleithral process exposed, smooth and triangular shaped, short and pointed posteriorly. Pelvic fin deep and short at base, with six rays. Adipose-fin base relatively short, less than one-half the length of anal-fin base, anterior origin at level of anterior half of anal fin. Anal fin shallow and moderately long at base, with 20–23 rays and distal margin slightly concave. Caudal peduncle moderately deep. Caudal fin forked, upper and lower lobes quite long, posteriorly pointed; upper lobe longer than lower lobe.

Coloration.—In alcohol, brown on dorsal portion, silvery brown on flanks, light beige to whitish ventrally, with scattered brown dots. Maxillary barbel dark brown, mental barbel lighter; adipose fin dark, other fins beige; pelvic fins with small brown dots.

Sexual Dimorphism.—Not investigated.

Distribution and Habitat.—Records of *Cathorops* species (including *C. liropus* and possibly *C. raredonae*) in the Pacific coast of Mexico are from the mouth of Yaqui River, Sonora (Miller et al., 2005) to Mar Muerto, Chiapas (Castro-Aguirre et al., 1999); material examined of *C. liropus* is from San Juan Lagoon, Sonora to Juchitan, Oaxaca (Fig. 8). Inhabits freshwaters and estuaries, rarely in adjacent marine coastal waters (Castro-Aguirre et al., 1999; Miller et al., 2005).

Size.—The largest specimen examined is 231.0 mm SL (IBUNAM-P 8246).

Phylogenetic Relationships.—No information is available.

Remarks.—Before the formal description of *T. liropus*, the species was reported as *Cathorops melanopus* (Jordan and Evermann, 1896), an ariid endemic to the Motagua River basin in Guatemala (Caribbean slope). Although *C. liropus* was recog-

nized as valid by Burgess (1989), the species has been largely neglected in modern literature. It has been recently treated as junior synonym of *C. fuerthii* (Kailola and Bussing, 1995; Castro-Aguirre et al., 1999; Marceniuk and Menezes, 2007) or listed as species inquirenda in *Cathorops* (Marceniuk and Ferraris, 2003; Ferraris, 2007).

The taxonomy of the species of *Cathorops* from the west coast of Mexico is complex and requires further investigation. In addition to *C. raredonae* (see below), our preliminary results suggest that there are least two related forms included within *C. liropus*, which may represent a species group. One entity (*C. liropus*), occurs from Sonora to Nayarit, and the other (*C.* aff. *liropus*) from Sinaloa to Oaxaca. *Cathorops liropus* is distinguished from *C.* aff. *liropus* by having a relatively longer supraoccipital process (11.4%–13.9% SL vs 10.9%–11.6% SL), relatively longer dorsal-fin (22.2%–24.5% SL vs 18.3%–22.7% SL) and pectoral-fin (19.0%–20.0% SL vs 15.6%–18.4% SL) spines, and longer dorsal (38.6%–39.8% SL vs 30.6%–35.0% SL) and ventral (32.5%–35.8% SL vs 28.0%–31.0% SL) lobes of caudal fin. We refrain from designating new nominal species due to limited number of examined specimens from each entity and the fact that their distributions overlap, making difficult to assess whether the observed differences can be in fact attributed to interspecific variation.

Material Examined.—All Mexico. Syntypes of *T. liropus*: USNM 47584 (2, 140.0–197.0 mm SL), Sonora, San Juan Lagoon, near mouth of Ahome River. Non-types: UMMZ 172001 (4, 83.0–95.0 mm SL), Nayarit, puente de Chacalilla on estero de San Blas, 12.07 km by road NNE of San Blas; UAZ 69-49-4 (1, 176.5 mm SL), Nayarit, San Blas; UAZ 68–36–2 (1, 124.5 mm SL), Gulf of California, Sinaloa, Altata Bay; IBUNAM-P 1008 (3, 120.0–185.0 mm SL), Oaxaca, Juchitan, Playa San Vicente (Laguna Superior), 16°23′7.00″N, 94°57′52.01″E; IBUNAM-P 8246 (1, 231.0 mm SL), Sinaloa; IBUNAM-P 883 (2, 221.0–228.0 mm SL), Oaxaca.

Cathorops (Cathorops) raredonae new species

Raredon's sea catfish or bagre de Raredon (Spanish)

(Figs. 4C, 5C; Tables 1–3, 5)

?*Cathorops fuerthii* (non Steindachner).—Allen and Robertson, 1994 (Mexico to Peru, in part); Kailola and Bussing, 1995: 880 (Mexico to Colombia, in part); De La Cruz Agüero et al., 1997: 59; Castro-Aguirre et al., 1999: 146 (San Juan Lagoon and Ahome River, Sonora to Mar Muerto, Chiapas; spelled *fuerthi*, in part); Kailola, 2004: 126 (in part); Miller et al., 2005: 171; Robertson and Allen, 2008 (Mexico to Peru, in part).

Cathorops sp *2*.—Marceniuk, 1997: 157 (El Salvador).

Cathorops aff. *fuerthii* (Steindachner).— Betancur-R. and Acero P., 2005: 55 (El Salvador); Betancur-R. et al., 2007: 349 (El Salvador).

Type Material.—Holotype**:** USNM 286464 (1, 178.0 mm SL), El Salvador, La Libertad, 29 Oct 1975, M. Miller. Paratypes**:** USNM 394093 (1, 161.0 mm SL), collected with holotype; STRI-5726 (STRI-15949) (2, 160.0–163.0 mm SL), El Salvador, Jiquilisco Bay, 13°13′7.0″N, 88° 31′44.0″W, 16 Dec 2001, R. Cooke; STRI 5738 (1, 162.0 mm SL), El Salvador, La Unión Bay, 13°12′15.1″N, 87°29′26.5″W, 17 Dec 2001, R. Cooke; STRI 5765 (1, 172.0 mm SL), El Salvador, La Unión Bay, 14°12′15.1″N,88°29′26.5″W, 16 Dec 2001, R. Cooke.

Non-Type Material.—INVEMAR-PEC 7863 (2, 165.0–192.0 mm SL), Mexico, coast of Sinaloa, 22°33′17.208″N ,105°51′37.188″W; FMNH 93606 (2, 163.0–168.8 mm SL), El Salvador, Chaguantique River, Jiquilisco Bay, sta. 5., 25 Aug 1976, P. Phillips et al.; USNM 220805 (2, 151.2–186.0 mm SL), El Salvador, Chaguantique River, Jiquilisco Bay, 23 Nov 1976, P. Phillips et al.; FMNH 93607 (1, 148.6 mm SL), El Salvador, La Venadona, Jiquilisco Bay, sta. 3., 7 Set 1976, P. Phillips et al.; USNM 220800 (in part, 1, 147.4 mm SL), El Salvador, El Potrero, Jiquilisco Bay, 02 Jun 1976, P. Phillips et al..

Diagnosis.—*Cathorops raredonae* differs from its consubgeners from the Eastern Pacific, except *C. fuerthii* and *C. manglarensis*, by having the dorsal-fin spine remarkably thinner than the pectoral-fin spine (Fig. 4C) (vs dorsal-fin spine thicker or as thick as pectoral-fin spine in *C. hypophthalmus*, *C. liropus*, *C. multiradiatus*, *C. steindachneri*, *C. taylori*, and *C. tuyra*; Fig. 4B,E), and caudal-fin lobes wide and rounded (Fig. 4C) (vs caudal-fin lobes narrow and pointed in *C. hypophthalmus*, *C. liropus*, *C. steindachneri*, *C. taylori*, and *C. tuyra*; Fig. 4D,E), 13–15 gill rakers on first arch (vs 16–19 in *C. liropus*, 37–40 in *C. hypophthalmus*, 16–19 in *C. multiradiatus*, 16–18 in *C. taylori*, and 19–22 in *C. tuyra*), orbital diameter 3.5%–4.2% SL (vs 5.0%–6.4% SL, in *C. liropus*, 4.7–5.3% SL in *C. steindachneri*, and 4.6%–5.7% SL in *C. taylori*; Fig. 6A), supraoccipital process length 8.7%–10.5% SL (10.9%–13.9% SL in *C. liropus*, 10.9%–13.9% SL in *C. hypophthalmus*, 11.7%–15.9% SL in *C. steindachneri*, and 11.2%–13.7% SL in *C. tuyra*; Fig. 6B).

Cathorops raredonae is further distinguished from *C. fuerthii* by possessing an osseous dorsomedial groove of neurocranium conspicuous and deep, with straight margins tapering posteriorly (Fig. 5C) (vs osseous dorsomedial groove of neurocranium inconspicuous and remarkably shallow, with irregular margins parallel along its entire extension; Fig. 3A), and a shorter distance between snout and maxillary barbel (1.3%–2.2% SL vs 2.3%–3.2% SL); from *C. manglarensis* by having 19–23 anal-fin rays (vs 24–27); from *C. hypophthalmus* by having the eye dorsal to the angle of mouth (vs at the same level or ventral to the angle of mouth), shorter dorsal-fin spine (16.4%–20.2% SL vs 25.0%–25.2% SL); from *C. multiradiatus* by having 19–23 anal-fin rays (vs 25–27); from *C. steindachneri* by possessing the fleshy portion of dorsomedial groove of neurocranium inconspicuous, wide and shallow, not continuous to the level of posterior nares (Fig. 5C) (vs fleshy groove conspicuous, narrow and deep, continuous to the level of to posterior nares; Fig. 2B); and from *C. tuyra* by having a shorter nuchal plate (6.0%–6.6% SL vs 6.7%–7.5% SL), thin lips (vs lips quite thick), and accessory tooth plates and posterior expansion of dentary with small molariform teeth (vs with large molariform teet).

Cathorops raredonae may be also distinguished from its closely related consubgeners from the Atlantic and Caribbean coasts of South America (see Phylogenetic relationships below) by having 13–15 gill rakers on first arch (vs 19–23 in *C. agassizii*, 17–22 in *C. arenatus*, 16–24 in *C. mapale* group, and 17–21 in *C. spixii*).

Description.—(Counts of anal fin rays and gill rakers on first and second arches given in Tables 1–3; morphometric data given in Table 5). Head moderately long and depressed, profile slightly elevated posteriorly, convex at frontal and supraoccipital areas. Snout moderately long and rounded transversaly. Anterior nostril rounded, with fleshy edge, posterior nostril covered by flap of skin; nostrils widely separated to one another and relatively distant from orbit, not connected by fleshy furrow. Eye lateral and small; eye widely separated. Three pairs of teretiforme barbels; maxillary

Table 5. Morphometric data for *Cathorops raredonae*. Standard length is expressed in millimeters, all other measurements are expressed in percents of standard length.

	Cathorops raredonae			
	Holotype–Paratypes	N	Mean	Range
Standard length (mm)	160.0–178.0	14		147.4–192.0
Head length	25.4–30.0	6	27.9	25.4–30.0
Snout length	6.3–8.6	6	7.4	6.3–8.6
Distance between anterior nostrils	4.0–5.5	6	4.8	4.0–5.5
Distance between posterior nostrils	5.0–7.4	6	6.1	5.0–7.4
Distance between anterior nostril and orbit	6.2–7.6	11	6.8	6.2–7.6
Distance between posterior nostril and orbit	4.6–5.7	5	5.0	4.6–5.7
Orbital diameter	3.5–4.2	6	3.9	3.5–4.2
Interorbital distance	12.5–15.4	6	13.5	12.5–15.4
Maxillary barbel length	24.6–31.0	6	26.5	24.6–31.0
Lateral mental barbel length	16.0–20.6	5	18.0	16.0–20.6
Mesial mental barbel length	9.9–11.2	4	10.5	9.9–11.2
Mouth width	9.6–11.0	12	10.2	9.1–11.1
Width of cephalic shield at lateral ethmoid area	12.3–14.3	10	13.1	12.3–14.3
Width of cephalic shield at frontals area	5.4–7.8	7	6.3	5.4–7.8
Width of cephalic shield at epioccipital area	11.2–12.6	5	11.8	11.2–12.6
Width of cephalic shield at supracleithrum area	17.2–19.1	5	17.9	17.2–19.1
Distance between lateral ethmoid and supracleithrum	21.4–26.9	11	23.4	21.0–26.9
Distance between snout and post. margin of dorsomedial groove of neurocranium	21.9–27.8	5	24.3	21.9–28.2
Supraoccipital process length	8.7–10.5	12	9.9	8.7–10.5
Supraoccipital process width	2.2–3.3	6	2.9	2.2–3.3
Nuchal–plate length	6.0–6.6	5	6.3	6.0–6.6
Nuchal–plate width	6.3–6.9	11	6.7	5.9–7.1
Body depth	16.0–19.9	5	17.6	16.0–19.9
Body width	20.1–22.7	6	21.2	20.1–22.7
Distance between snout to maxillary barbell	1.3–2.2	5	1.7	1.3–2.2
Distance from snout to pectoral fin	21.9–26.8	6	24.1	21.9–26.8
Distance from snout to dorsal fin	33.2–39.9	6	36.6	33.2–39.9
Distance from snout to pelvic fin	49.7–54.4	6	51.5	49.7–54.4
Distance from snout to adipose fin	73.6–78.8	6	75.8	73.6–78.8
Distance from snout to anal fin	64.9–72.8	6	68.2	64.9–72.8
Caudal–peduncle height	7.9–8.9	6	8.5	7.9–8.9
Pectoral–fin spine length	16.4–20.2	6	18.7	16.4–20.2
Dorsal–fin spine length	16.9–20.1	7	18.9	16.9–20.3
Pelvic–fin base length	3.4–4.1	6	3.9	3.4–4.1
Pelvic–fin height	13.4–15.9	6	14.2	13.4–15.9
Adipose–fin base length	6.8–8.7	4	8.0	6.8–8.7
Adipose–fin height	3.4–4.3	3	3.9	3.4–4.3
Anal–fin base length	17.7–20.9	6	19.0	17.7–20.9
Anal–fin height	12.8–15.3	5	13.5	12.8–15.3
Caudal–fin upper lobe length	28.3–33.3	4	31.1	28.3–33.3
Caudal–fin lower lobe length	25.5–30.4	4	28.3	25.5–30.4

barbel reaching base of pectoral-fin spine, lateral mental barbel reaching margin of gill membrane, mesial mental barbel not reaching margin of gill membrane. Osseous bridge formed by lateral ethmoid and frontal long and slender, evident under skin. Cephalic shield exposed, rough and granulated, evident on postorbital region; shield long and wide on lateral ethmoid area, relatively narrow on frontal, supracleithrum, and epioccipital areas. Anterior portion of dorsomedial groove of neurocranium fleshy, wide and shallow, inconspicuous and not continuous to the level of posterior nares; posterior portion of groove osseous, deep and conspicuous, with straight margins tapering posteriorly. Supraoccipital process funnel-shaped, relatively short and narrow on posterior portion. Nuchal plate crescent-shaped, short and narrow.

Mouth subterminal to terminal, relatively large; lower jaw arched. Lips thin, lower lip thinner than upper lip. Vomerine tooth plates absent. One pair of relatively small oval-shaped accessory tooth plates, relatively separated from one another, with large molariform teeth. Premaxilla relatively long and narrow, with sharp teeth, sometimes fused at symphysis. Dentary separated at midline, with pronounced posterior expansion and sharp teeth on anterior portion, molariform teeth on posterior portion, and some conical teeth in between. Gill membranes fused, attached to isthmus. Thirteen to fifteen acicular gill rakers on first arch, 13–16 spike shaped gill rakers on second arch. Mesial surfaces of all gill arches with developed gill rakers, lateral and mesial surfaces of first and second gill arches lacking fleshy papillae intercalated with gill rakers.

Body width greater than body depth at pectoral girdle area, progressively more compressed from pectoral fin to caudal peduncle. Lateral line sloping ventrally on anterior one-third, extending posteriorly to caudal peduncle, bending abruptly onto dorsal lobe of caudal fin. Dorsal-fin spine short and quite thin, remarkably thinner than pectoral-fin spine; anterior margin with granules on basal two-thirds, distal one-third with short serrations; posterior margin serrated along almost its entire length. Seven dorsal-fin soft rays. Pectoral-fin spine short and thick; anterior margin with granules on basal two-thirds, distal one-thirds with short serrations; posterior margin straight on basal one-fourth, distal three-fourths with short serrations. Ten or eleven pectoral-fin soft rays. Posterior cleithral process exposed, smooth and triangular shaped, short and pointed posteriorly. Pelvic fin moderately deep and long at base, with six rays. Adipose-fin base short, less than one-half the length of anal-fin base, anterior origin at level of anterior half of anal fin. Anal fin shallow and long at base, with 19–23 rays and distal margin slightly concave. Caudal peduncle deep. Caudal fin forked, upper and lower lobes short, posteriorly round; upper lobe longer than lower lobe.

Coloration.—In alcohol**,** purple brown on dorsal portion, progressively lighter towards lateral line, beige ventrally. Maxillary barbel dusky, mental barbels lighter; adipose fin purple brown, other fins beige, pelvic fins with small brown dots.

Sexual Dimorphism.—Sexual dimorphism was observed in two females (162.0–178.0 mm SL) and three males (160.0–172.0 mm SL). Males have larger head, as evidenced by greater head length (26.6%–30.0% SL vs 25.4%–25.6% SL), greater snout length (7.1%–7.4% SL vs 6.3%–7.0% SL), and greater distance between anterior nostril and orbit (6.6%–7.6% SL vs 6.2%–6.4% SL). Head wider in males than in females, as evidenced by greater interorbital distance (13.4%–15.4% SL vs 12.5%–13.0% SL), greater distance between anterior nostrils (5.1%–5.5% SL vs 4.0%–4.4% SL), and wider cephalic shield at lateral ethmoid area (13.3%–14.3% SL vs 12.3%–12.6% SL),

frontal area (5.9%–7.8% SL vs 5.4%–5.8% SL), supracleithrum area (17.9%–19.1% SL vs 17.2%–17.4% SL), and epioccipital area (11.9%–12.6% SL vs 11.2%–11.3% SL). Males with longer dorsal-fin (18.3%–20.1% SL vs 16.9%–17.9% SL) and pectoral-fin (18.1%–19.7% SL vs 16.4%–18.1% SL) spines than females.

Males have larger mouths (10.5%–10.9% SL vs 9.6%–9.6% SL), and shorter (1.2%–1.3% SL vs 1.5%–1.8% SL) premaxilla than females. Accessory tooth plates with smaller and fewer molariform teeth in males than in females; plates more distant to one another in males than in females (5.7%–7.6% SL vs 4.3%–5.7% SL) (Fig. 9). Posterior expansion of dentary longer in females than in males; females with more molariform teeth than males (Fig. 9). Females with longer pelvic fins (14.0%–15.9% SL vs 13.0%–14.0% SL), deeper anal fins (13.3%–15.3% SL vs 12.8%–13.0% SL), and shorter caudal-fin upper lobe (28.3%–30.9% SL vs 31.4%–31.7% SL) than males.

Distribution and Habitat.—Known from Mexico (Sinaloa) and El Salvador (La Libertad to La Unión) (Fig. 8). Inhabits freshwaters, estuaries, and inshore marine waters.

Derivation of Name.—The specific epithet, *raredonae*, is to honor Sandra J. Raredon, Division of Fishes, National Museum of Natural History, Washington, DC, for her valuable assistance in many curatorial duties.

Size.—The largest specimen examined is 192.0 mm SL (INVEMAR-PEC 7863).

Phylogenetic Relationships.—*Cathorops raredonae* is sister to *C. fuerthii* and that clade is sister to the *C. mapale* species group from the southern Caribbean. This clade is also closely related to a clade including *C. agassizii* and *C. spixii* (and possibly *C. arenatus*) from the Atlantic coast of South America (Betancur-R. et al., 2007; Fig. 1).

Cathorops (Cathorops) steindachneri (Gilbert and Starks, 1904)

Steindachner's sea catfish or congo baboso (Spanish)

(Figs. 4D, 5D; Tables 1–3, 6)

Arius melanopus (non Günther).—Jordan and Gilbert, 1883: 109 (Panama, in part).

Tachisurus melanopus (non Günther).—Eigenmann and Eigenmann, 1890: 88 (West Coast Tropical America; in part).

Tachysurus steindachneri Gilbert and Starks, 1904: 29–30, PL. V, fig. 9 [Holotype: SU 7026. Paratypes: SU 7027 (1). Type-locality: Pacific, Panama].

Arius steindachneri (Gilbert and Starks).—Meek and Hildebrand, 1923: 127 (Balboa, Panama).

Cathorops taylori (non Hildebrand).—Allen and Robertson, 1994: 69 (Guatemala to Panama, in part).

Cathorops steindachneri (Gilbert and Starks).—Bussing and López, 1994: 58; Kailola and Bussing, 1995: 882 (El Salvador to Panama, in part); Marceniuk and Ferraris, 2003: 450 (Western Central America, in part); Kailola, 2004: 132; Betancur-R. et al., 2007: 349; Ferraris 2007: 40 (Western Central America); Marceniuk, 2007a: 46 (in part); Marceniuk and Menezes, 2007: 45 (Western Central America, in part); Robertson and Allen, 2008 (Costa Rica to Peru, in part).

Diagnosis.—*Cathorops steindachneri* can be distinguished from its consubgeners from the Eastern Pacific by having the fleshy portion of dorsomedial groove conspicuous, narrow and deep, continuous to the level of posterior nares (Fig. 2B) (vs fleshy portion of dorsomedial groove of neurocranium inconspicuous, wide and shallow,

not continuous to the level of posterior nares in other species, except in *C. fuerthii* and *C. liropus* whose fleshy portion of dorsomedial groove is also shallow and wide, but continuous to the level of posterior nares; Fig. 5A,B,C,E), caudal-fin lobes narrow and pointed posteriorly (Fig. 4D) (vs caudal-fin lobes wide and rounded posteriorly in *C. fuerthii*, *C. manglarensis*, *C. multiradiatus*, and *C. raredonae*; Fig. 4A,C), dorsal-fin spine thicker than pectoral-fin spine (vs dorsal-fin spine remarkably thinner than pectoral-fin spine in *C. fuerthii*, *C. manglarensis*, and *C. raredonae*; Fig. 4A,C), and orbital diameter 4.7%–5.3% SL (vs 3.2%–4.2% SL in *C. fuerthii*, 3.0%–3.5% SL in *C. hypophthalmus*, 3.5%–4.2% SL in *C. raredonae*; Fig. 6A).

Cathorops steindachneri is further distinguished from *C. fuerthii* by having an osseous dorsomedial groove of neurocranium conspicuous and deep, with straight margins that taper posteriorly (Fig. 2B) (vs osseous dorsomedial groove of neurocranium inconspicuous and remarkably shallow, with irregular margins parallel along its entire length; Fig. 3A), shorter distance between posterior nostrils (4.5%–5.3% SL vs 5.8%–7.3% SL); and longer supraoccipital process (11.7%–15.9% SL 10.4%–11.9% SL) from *C. hypophthalmus* by possessing the eye dorsal to the angle of mouth (vs at the same level or ventral to the angle of mouth), 15–17 gill rakers on first arch (vs 37–40), shorter snout (6.7%–7.3% SL vs 8.6%–9.6% SL), and shorter distance between posterior nostrils (4.5%–5.3% SL vs 8.2%–8.5% SL); from *C. manglarensis* by having 20–23 anal-fin rays (vs 24–27); from *C. multiradiatus* by possessing 20–23 anal-fin rays (vs 25–27), and longer supraoccipital process (11.7%–15.9% SL vs 9.8%–11.5% SL); from *C. raredonae* by having a longer supraoccipital process (11.7%–15.9% SL vs 8.7–11.9); from *C. taylori* by having a shorter snout (6.7%–7.3% SL vs 7.4%–8.3% SL; Fig. 6B), and longer supraoccipital process (11.7%–15.9% SL vs 9.4%–10.6% SL; Fig. 6B); and from *C. tuyra* by having 15–17 gill rakers on first arch (vs 19–22), thin lips (vs lips quite thick), and accessory tooth plates and posterior expansion of dentary with small molariform teeth (vs with large molariform teeth).

Description.—(Counts of anal fin rays and gill rakers on first and second arches given in Tables 1–3; morphometric data given in Table 6). Head relatively short and depressed, profile slightly elevated posteriorly and convex at frontal and supraoccipital area. Snout short and rounded transversely. Anterior nostril rounded, with fleshy edge, posterior nostril covered by flap of skin; nostrils quite close to one another and relatively close from orbit, note connected by fleshy furrow. Eye lateral and large; eyes relatively close to one another. Three pair of teretiforme barbels; maxillary barbel reaching base of pectoral-fin spine, lateral mental barbel reaching margin of gill membrane, and mesial mental barbel not reaching margin of gill membrane. Osseous bridge formed by lateral ethmoid and frontal long and slender, evident under skin. Cephalic shield exposed, rough and granulated, evident on postorbital region; shield short and relatively narrow on lateral ethmoid, frontal, and supraoccipital areas. Anterior portion of dorsomedial groove of neurocranium fleshy, narrow, and deep, conspicuous and continuous to the level of posterior nares; posterior portion of groove osseous, deep and conspicuous, with straight margins tapering posteriorly. Supraoccipital process funnel-shaped, quite long and wide on posterior portion. Nuchal plate crescent-shaped, short, and relatively narrow.

Mouth subterminal to terminal, relatively small; lower jaw arched. Lips thin, lower lip thinner than upper lip. Vomerine tooth plates absent. One pair of oval shaped accessory tooth plates, variable in size, relatively separated from one another on anterior portion, with molariform teeth. Premaxilla relatively long and narrow, with

Table 6. Morphometric data for *Cathorops steindachneri* and *Cathorops taylori*. Standard length is expressed in millimeters, all other measurements are expressed in percents of standard length.

	Cathorops steindachneri				*Cathorops taylori*			
	Holotype–Paratype	N	Mean	Range	Holotype	N	Mean	Range
Standard length (mm)	168.8–210.0	10		107.3–210.0	283.0	10		139.0–282.0
Head length	25.2	2	26.1	25.2–27.0	25.8	8	26.4	25.4–28.7
Snout length	6.7	2	7.0	6.7–7.3	7.8	8	7.8	7.4–8.3
Distance between anterior nostrils	4.0–4.2	3	4.2	4.0–4.3	4.0	7	4.3	3.5–5.1
Distance between posterior nostrils	5.3	2	4.9	4.5–5.3	5.0	8	5.3	4.5–6.0
Distance between anterior nostril and orbit	5.5	6	6.1	5.5–6.5		8	6.7	6.3–6.9
Distance between posterior nostril and orbit	4.1	1		4.1		6	5.1	4.6–6.1
Orbital diameter	5.0–5.3	4	5.0	4.7–5.3	4.6	8	5.3	4.6–5.7
Interorbital distance	11.6–12.0	3	12.4	11.6–13.6	11.8	8	12.4	11.6–13.1
Maxillary barbel length	25.5	2	27.2	25.5–28.8	21.1	8	25.0	17.5–31.4
Lateral mental barbel length	18.7	2	18.9	18.7–19.0	14.2	8	16.1	13.2–19.3
Mesial mental barbel length	11.3	2	10.7	10.1–11.3	9.3	3	9.3	8.3–10.3
Mouth width	9.0	8	8.8	7.8–10.1	8.1	8	9.8	8.1–10.4
Width of cephalic shield at lateral ethmoid area	11.6–12.9	9	12.1	11.4–13.1		8	12.2	10.1–13.2
Width of cephalic shield at frontals area	5.5	1	5.5	5.5	7.0	6	6.3	5.9–6.9
Width of cephalic shield at epioccipital area						6	17.7	16.6–18.7
Width of cephalic shield at supracleithrum area	17.0	1	17.0	17.0		6	11.4	11.0–12.1
Distance between lateral ethmoid and supracleithrum	19.8	8	20.7	19.8–22.9		8	23.0	21.5–24.3
Distance between snout and post. margin of dorsomedial groove of neurocranium	24.8	1	24.8	24.8	24.5	6	23.5	22.1–26.4
Supraoccipital process length	11.7–11.7	9	13.5	11.7–15.9	10.6	8	10.3	9.4–10.6
Supraoccipital process width	3.0	2	29.0	2.7–3.0	2.8	8	2.7	2.5–2.9
Nuchal–plate length	4.7–6.3	2	5.5	4.7–6.3	6.7	6	7.0	6.5–8.3
Nuchal–plate width	5.1–7.0	6	6.2	5.1–7.5		7	7.1	6.2–8.0
Body depth						6	16.3	14.6–18.6
Body width	20.4	1		20.4	19.4	8	20.4	19.0–22.4

Table 6. Continued.

	Cathorops steindachneri				*Cathorops taylori*			
	Holotype–Paratype	N	Mean	Range	Holotype	N	Mean	Range
Distance from snout to pectoral fin	20.5	2	21.3	20.5–22.0	25.4	8	23.5	21.7–25.4
Distance from snout to dorsal fin	37.5	2	36.4	36.2–37.5	36.0	8	36.5	35.5–37.7
Distance from snout to pelvic fin	49.5	2	50.8	49.5–52.0	52.7	8	53.6	52.7–54.3
Distance from snout to adipose fin	73.3	2	74.9	73.3–76.5	71.7	8	75.1	71.7–76.6
Distance from snout to anal fin	68.1	2	67.3	66.5–68.1	65.4	7	69.1	65.3–71.9
Caudal–peduncle height	7.2	2	7.7	7.2–8.1	8.3	8	7.9	6.9–8.6
Pectoral–fin spine length	18.0–19.6	3	18.2	17.0–19.6	16.6	7	16.9	15.6–18.4
Dorsal–fin spine length	16.8–18.6	8	18.9	16.8–22.2	19.4	6	19.4	17.9–20.3
Pelvic–fin base length	4.5	2	3.9	3.2–4.5	3.3	8	3.4	3.0–3.9
Pelvic–fin height	17.9	2	15.7	13.4–17.9	13.4	8	13.6	12.3–16.3
Adipose–fin base length	8.3	2	8.7	8.3–9.1	8.3	7	7.6	6.6–8.5
Adipose–fin height	3.6	1		3.6		3	4.4	4.1–5.0
Anal–fin base length	17.2	2	17.4	17.2–17.5	17.3	7	16.5	15.4–17.4
Anal–fin height	19.5	1		19.5		5	12.4	9.1–14.9
Caudal–fin upper lobe length	25.1	1		25.1		5	32.1	30.0–33.7
Caudal–fin lower lobe length	23.8					5	28.7	27.4–31.2

sharp teeth, sometimes fused at symphysis. Dentary separated at midline, with pronounced posterior expansion and sharp teeth on anterior portion, molariform teeth on posterior portion and some conical teeth in between. Gill membranes fused, attached to isthmus. Fifteen to seventeen acicular gill rakers on first arch, 16–17 spike shaped gill rakers on second arch. Mesial surfaces of all gill arches with developed gill rakers, lateral and mesial surfaces of first and second gill arches lacking fleshy papillae intercalated with gill rakers.

Body width greater than body depth at pectoral girdle area, progressively more compressed from pectoral fin to caudal peduncle. Lateral line sloping ventrally on anterior one-third, extending posteriorly to caudal peduncle, bending abruptly onto dorsal lobe of caudal fin. Dorsal-fin spine short and thick, thicker or as thick as pectoral-fin spine; anterior margin with granules on basal two-thirds, distal one-third with short serrations; posterior margin with short serrations along almost its entire length. Seven dorsal-fin soft rays. Pectoral-fin spine short and thick; anterior margin with quite short serrations along almost its entire length; posterior margin straight on basal one-fourth, distal three-fourth with short serrations. Ten or eleven pectoral-fin soft rays. Posterior cleithral process exposed, smooth and triangular shaped, short and pointed posteriorly. Pelvic fin deep and long at base, with six rays. Adipose-fin base relatively short, less than one-half the length of anal-fin base, anterior origin at level of anterior half of anal fin. Anal fin deep and short at base, with 20–23 rays and distal margin slightly concave. Caudal peduncle relatively low. Caudal fin forked, upper and lower lobes short, posteriorly pointed; upper lobe longer than lower lobe.

Coloration.—In life, dark gray on dorsum, silvery white on sides and whitish on venter; fins dusky. In alcohol, brown on dorsal and lateral portions, progressively lighter towards lateral line, light beige ventrally, with scattered dusky dots. Maxillary barbel brown, mental barbel lighter; adipose fin dark, other fins darker than venter, with small dark dots.

Sexual Dimorphism.—Not investigated.

Distribution and Habitat.—Known from El Salvador, Costa Rica (Bussing and López, 1994) and Panama (Fig. 8). Reported to occur in marine and estuarine waters as well as freshwater (Kailola and Bussing, 1995); however, it has not been found in freshwater in Panama (R. Cooke, Smithsonian Tropical Research Institute, pers. comm.).

Phylogenetic Relationships.—*Cathorops steindachneri* is closely related to *C. taylori*, and both species are sister to a clade including *C. hypophthalmus* and *C. tuyra* (Betancur-R. et al., 2007; Fig. 1).

Material Examined.—Holotype of *T. steindachneri*, SU 7026 (1, 168.8 mm SL), Panama. Paratype of *T. steindachneri*, SU 7027 (1, 210.0 mm SL), collected with holotype. Non-types**:** USNM 368351 (1, 119.0 mm SL), El Salvador, Gulf of Fonseca; USNM 220800 (in part, 3, 141.8–144.0 mm SL), El Salvador, El Potrero, Jiquilisco Bay; STRI-5725 (STRI-17236) (1, 200.0 mm SL), Panama, Majagual Island; USNM 79353 (2, 107.3–141.07 mm SL), Panama Bay, Balboa, Canal Zone; FMNH 32053 (1, 139.5 mm SL), Panama Bay, Balboa, Canal Zone. STRI-07145 (STRI-21677) (1, 169.0 mm SL), Guarumal, Veraguas, Panama; STRI-07148 (STRI-21680) (1, 186.0 mm SL), Guarumal, Veraguas, Panama; STRI-07151 (STRI-21683) (1), Agua Dulce, Coclé, Panama.

Cathorops (Cathorops) taylori (Hildebrand, 1925)
Taylor's sea catfish or bagre de Taylor (Spanish)
(Figs. 4E, 5E; Tables 1–3, 6)

Tachisurus melanopus (not Günther).—Eigenmann and Eigenmann, 1890: 88 (west coast tropical America; in part).
Arius taylori Hildebrand, 1925: 250, Fig. 10 [Type-locality: Lempa River, San Marcos, El Salvador. Holotype: USNM 87224. Paratypes: FMNH missing (1)].—Burgess, 1989: 169.
Cathorops taylori (Hildebrand).—Allen and Robertson, 1994: 69; Betancur-R. et al., 2007: 349; Robertson and Allen, 2008 (Mexico to El Salvador).
Cathorops steindachneri (non Gilbert and Starks).—Kailola and Bussing, 1995: 882 (Western Central America, El Salvador to Panama, in part); Marceniuk and Ferraris, 2003: 450 (Western Central America, in part); Kailola, 2004: 123; Ferraris, 2007: 40 (Western Central America) Marceniuk, 2007a: 46 (in part); Marceniuk and Menezes, 2007: 45 (Guatemala to Panama, in part).
Cathorops cf. *taylori* (Hildebrand).—Betancur-R. and Acero P., 2005: 55.

Diagnosis.—*Cathorops taylori* can be differentiated from its consubgeners from the Eastern Pacific by having caudal-fin lobes narrow and pointed posteriorly (Fig. 4E) (vs caudal-fin lobes wide and rounded posteriorly in *C. fuerthii*, *C. manglarensis*, *C. multiradiatus*, and *C. raredonae*; Fig. 4A,C), dorsal-fin spine thicker or as thick as pectoral-fin spine (Fig. 4E) (vs dorsal-fin spine remarkably thinner than pectoral-fin spine in *C. fuerthii*, *C. manglarensis*, and *C. raredonae*; Fig. 4A,C), orbital diameter 4.6%–5.7% SL (vs 3.2%–4.2% SL in *C. fuerthii*, 3.0%–3.5% SL in *C. hypophthalmus*, and 3.5%–4.2% SL in *C. raredonae*; Fig. 6A), snout length (7.4%–8.3% SL vs 5.5%–6.9% SL in *C. multiradiatus*, and 6.7%–7.3% SL in *C. steindachneri*), and supraoccipital process length 9.4%–10.6% SL (vs 10.9%–13.9% SL in *C. liropus*, 12.1%–12.2% SL in *C. hypophthalmus*, 11.7%–15.9% SL in *C. steindachneri*, and 11.2%–13.7% SL in *C. tuyra*; Fig. 6B).

Cathorops taylori is further distinguished from *C. fuerthii* by having osseous dorsomedial groove of neurocranium conspicuous and deep, with straight margins tapering posteriorly (Fig. 5E) (vs osseous dorsomedial groove inconspicuous and remarkably shallow, with irregular margins parallel along its entire extension; Fig. 3A); from *C. hypophthalmus* by having the eye dorsal to the angle of mouth (vs at the same level or ventral to the angle of mouth), 16–18 gill rakers on first arch (vs 37–40); from *C. liropus* by having nuchal plate length 0.97–1.3 in width of cephalic shield at frontal area (vs 0.82–0.96); from *C. manglarensis* by having 20–23 anal-fin rays (vs 24–27), and shorter pectoral-fin spine (15.6%–18.4% SL vs 18.5%–22.5% SL); from *C. multiradiatus* by having 20–23 anal-fin rays (vs 25–27); from *C. steindachneri* by having a fleshy portion of dorsomedial groove of neurocranium inconspicuous, wide and shallow, not continuous to the level of posterior nares (Fig. 5E) (vs fleshy dorsomedial groove of neurocranium conspicuous, narrow and deep, continuous to the level of posterior nares; Fig. 2B); and from *C. tuyra* by having 16–18 gill rakers on first arch (vs 19–22), thin lips (vs lips quite thick), and accessory tooth plates and posterior expansion of dentary with small molariform teeth (vs with large molariform teeth).

Description.—(Counts of anal fin rays and gill rakers on first and second arches given in Tables 1–3; morphometric data given in Table 6). Head moderately long and

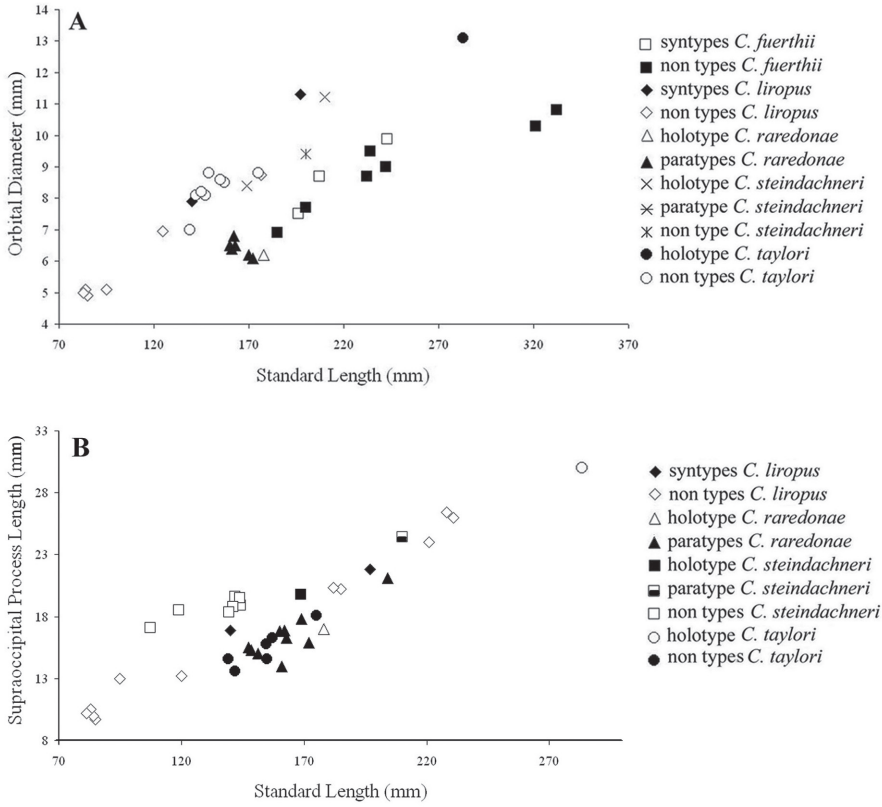

Figure 6. Plots of (A) orbital diameter, (B) supraoccipital process length vs standard length.

depressed, profile slightly elevated posteriorly and concave at frontal and supraoccipital area. Snout long and rounded transversely. Anterior nostril round, with fleshy edge, posterior nostril covered by flap of skin; nostrils close to one another and relatively distant from orbit, not connected by fleshy furrow. Eye lateral and large; eye close to one another. Three pair of teretiforme barbels; maxillary barbel reaching base of pectoral-fin spine, lateral mental barbel sometimes reaching margin of gill membrane, mesial mental barbel not reaching margin of gill membrane. Osseous bridge formed by lateral ethmoid and frontal long and slender, slightly evident under skin. Cephalic shield exposed, rough and granulated, slightly evident on postorbital region; shield long and relatively narrow on lateral ethmoid, frontal, supracleithrum, and supracleithrum areas. Anterior portion of dorsomedial groove of neurocranium fleshy, inconspicuous and not continuous to the level of posterior nares; posterior portion of groove osseous, deep and conspicuous, with straight margins tapering posteriorly. Supraoccipital process funnel-shaped, relatively short and narrow on posterior portion. Nuchal plate crescent-shaped, long and wide.

Mouth subterminal to terminal, relatively small; lower jaw arched. Lips thin, lower lip thinner than upper lip. Vomerine tooth plates absent. One pair of oval shaped accessory tooth plates, variable in size, relatively separated from one another on anterior portion, with molariform teeth. Premaxilla relatively long and narrow, with sharp teeth, sometimes fused at symphysis. Dentary separated at midline, with pro-

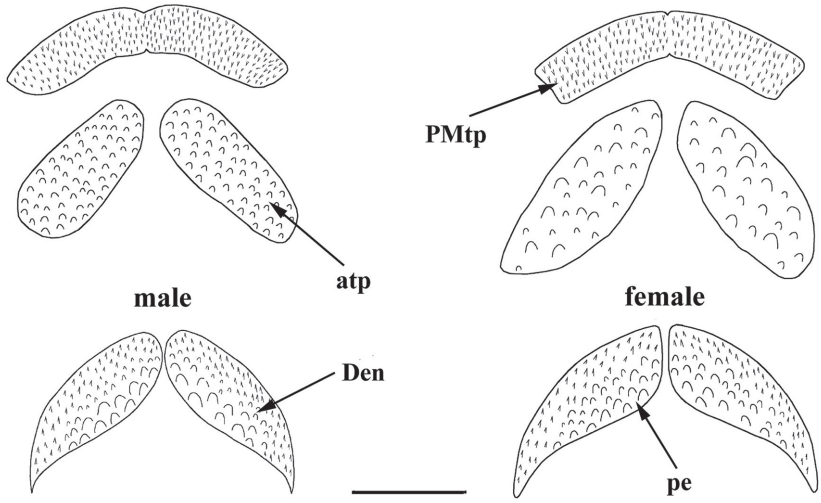

Figure 7. Tooth plates of *Cathorops fuerthii*. Abbreviations: atp–accessory tooth plates; Den–Dentary; pe–posterior expansion; PMtp–Premaxillary tooth plate. Scale bar = 2 mm.

nounced posterior expansion and sharp teeth on anterior portion, molariform teeth on posterior portion, and some conical teeth in between. Gill membranes fused, attached to isthmus. Sixteen to eighteen acicular gill rakers on fist arch, 16 spike shaped gill rakers on second arch. Mesial surfaces of all gill arches with developed gill rakers, lateral and mesial surfaces of first and second gill arches lacking fleshy papillae intercalated with gill rakers.

Body width greater than body depth at pectoral girdle area, progressively more compressed from pectoral fin to caudal peduncle. Lateral line sloping ventrally on anterior one-third, extending posteriorly to caudal peduncle, bending abruptly onto dorsal lobe of caudal fin. Dorsal-fin spine short and thick, thicker or as thick as pectoral-fin spine; anterior margin smooth on proximal three-fourths, distal one-fourth with short serrations; posterior margin with conspicuous serrations along almost entire length. Seven dorsal-fin soft rays. Pectoral-fin spine short and thick; anterior margin with granules on basal two-thirds, distal one-third with short serrations; posterior margin with short and conspicuous serrations on distal three-fourths. Ten or eleven pectoral-fin soft rays. Posterior cleithral process exposed, smooth and triangular shaped, short and pointed posteriorly. Pelvic fin moderately deep and short at base, with six rays. Adipose-fin base relatively short, less than one-half the length of anal-fin base, anterior origin at level of anterior half of anal fin. Anal fin shallow and short at base, with 20–23 rays and distal margin slightly concave. Caudal peduncle moderately deep. Caudal fin forked, upper and lower lobes relatively short, posteriorly pointed; upper lobe longer than lower lobe.

Coloration.—In alcohol, dark brown on dorsal and lateral portions, progressively lighter towards lateral line, light beige ventrally. Maxillary barbel dark brown, mental barbel lighter; adipose dark brown, other fins darker than venter, with small dark dots.

Sexual Dimorphism.—Not investigated.

Distribution and Habitat.—Material examined is from Guatemala and El Salvador. Reported from southern Mexico to Panama (Kailola and Bussing, 1995; Marceniuk

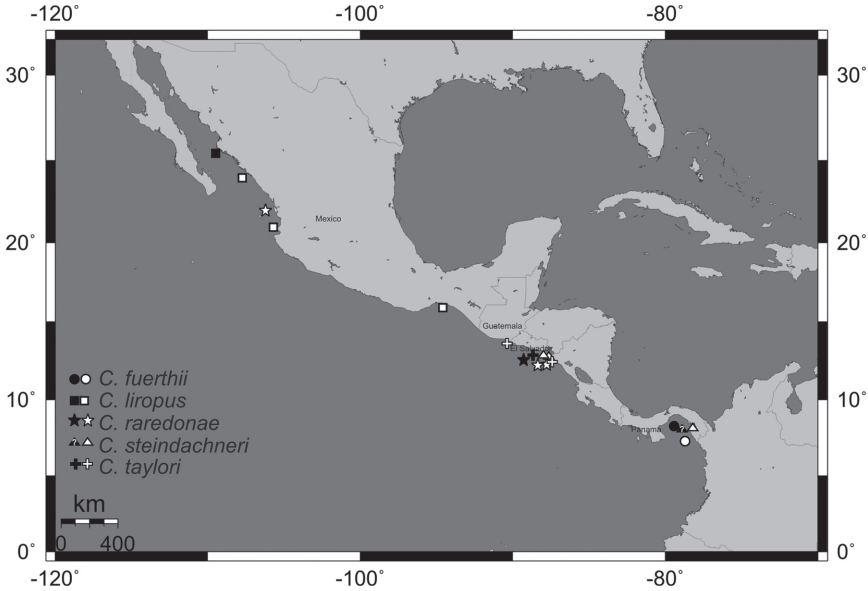

Figure 8. Sampling localities of examined material. Filled symbols represent type localities; open symbols represent other localities; question mark in the filled triangle indicates imprecise locality. Some symbols indicate more than one locality or lot of specimens (from www.aquarius.geomar.de).

and Menezes, 2007; Robertson and Allen, 2008). Although its presence in Mexico can not be ruled out, the occurrence in Panama is improbable (Fig. 8). Reported to inhabit brackish river mouths and freshwaters (Robertson and Allen, 2008); material examined from La Unión Bay was collected in high salinity estuaries.

Phylogenetic Relationships.—*Cathorops taylori* is sister to *C. steindachneri*, and that clade is sister to a clade including *C. hypophthalmus* and *C. tuyra* (Betancur-R. et al., 2007; Fig. 1).

Material Examined.—Holotype of *A. taylori*, USNM 87224 (1, 283.0 mm SL), El Salvador, San Marcos, Lempa River, 08 Feb 1924, S. F. Hildebrand and F. J. Foster. Non-types: STRI-5727 (STRI-15952) (2, 145.0–147.0 mm SL), El Salvador, La Unión Bay; STRI 5743 (2, 139.0–142.0 mm SL), El Salvador, La Unión Bay; STRI 5768 (2, 155.0–157.0 mm SL), El Salvador, La Unión Bay; STRI 5767 (1, 175.0 mm SL), El Salvador, La Unión Bay; AMNH 32448 (2, 154,6–145.0 mm SL), Guatemala, Santa Rosa, Chiquimulilla Canal, 1 km south of La Avellana.

Discussion

Despite the well-supported monophyly and subgeneric divisions of *Cathorops* based on both molecular and morphological characters (Betancur-R. et al., 2007; Marceniuk and Menezes, 2007; Marceniuk and Betancur-R., 2008) (see Appendix I), the taxonomy and nomenclature of the species in the genus are problematic. A few species have conspicuously diagnostic features and hence are taxonomically well defined. The limits and statuses of most nominal species, however, have been largely unstable in the literature mainly due to difficulties in finding consistent characteristics to define the species.

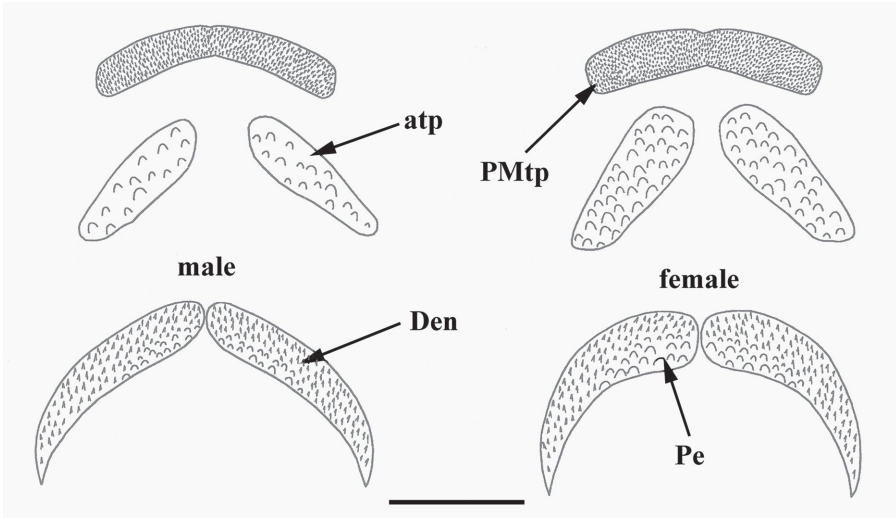

Figure 9. Tooth plates of *Cathorops raredonae*. Abbreviations: atp–accessory tooth plates; Den–Dentary; pe–posterior expansion; PMtp–Premaxillary tooth plate. Scale bar = 2 mm.

Including the new species, 17 nominal species of *Cathorops* are reported from Eastern Pacific and ten or 11 (see comments on *A. festae* below) are valid (Table 7). The subgenus *Precathorops* is monotypic, including *Arius dasycephalus* [*Tachisurus longicephalus* Eigenmann and Eigenmann, 1888 is a junior synonym (Meek and Hildebrand, 1923; Kailola and Bussing, 1995; Marceniuk and Menezes, 2007)]. All other species belong in the subgenus *Cathorops*. Four species in the subgenus *Cathorops* are well-defined in the literature and are not taxonomically problematic. The Gloomy sea catfish *C. hypophthalmus*, type species of the genus, occurs in the Pacific coast of Panama and inhabits brackish and freshwaters. It is easily differentiated by having a more ventrally placed eye, located at the same level or lower than the angle of mouth (vs eye dorsal to the angle of mouth in other species), and 37–40 gill rakers in first and second gill arches (vs 13–23 in other species). *Tachisurus gulosus* has been recognized as a junior synonym of this species for over a century (Regan, 1907; Kailola and Bussing, 1995; Marceniuk and Ferraris, 2003; Marceniuk and Menezes, 2007). The Besudo sea catfish *C. tuyra* has a distributional range and habitat similar to *C. hypophthalmus*. This species is easily separated from its congeners by having extraordinarily developed molariform teeth on the accessory plates, posterior portion of dentary well developed with large molariform teeth posteriorly, small mouth with fleshy lips, and the combination of 19–20 anal-fin rays and 19–22 gill rakers of first gill arch. The Box sea catfish *C. multiradiatus*, distributed from Panama to Peru, has been diagnosed from its congeners by having 25–27 anal-fin rays (vs 19–24 in other Eastern Pacific species). Recently, Marceniuk (2007a) described a new species from southwestern Colombia with similar anal-fin counts to *C. multiradiatus* (the Mangrove sea catfish *C. manglarensis*). The author provided inclusive diagnoses for both *C. multiradiatus* and *C. manglarensis*, and confirmed that *Tachysurus emmelane* and *Tachysurus equatorialis* are junior synonyms of the former species and that *Bagrus arioides* is an unavailable senior synonym (Regan, 1907; Meek and Hildebrand, 1923; Hildebrand, 1946).

Table 7. Nominal species of *Cathorops* from Eastern Pacific, with current taxonomic status and distribution. Abbreviations: d.–distribution; j.s.–junior synonym; n.p.–name preoccupied; s.s.–senior synonym; t.l.–type locality; v.–valid.

Nominal species	Current status	Distribution
Bagrus arioides Kner, 1863	n.p. and s.s. of *C. (Cathorops) multiradiatus*	t.l. Bayano River, Panama
Arius dasycephalus Günther, 1864	v. as *C. (Precathorops) dasycephalus*	d. Panama to Ecuador
Tachysurus emmelane Gilbert, 1898	j.s. of *C. (Cathorops) multiradiatus*	t.l. Panama
Tachysurus equatorialis Starks, 1906	j.s. of *C. (Cathorops) multiradiatus*	t.l. Guayaquil, Ecuador
Tachysurus evermanni Gilbert and Starks, 1904	j.s. of *C. (Cathorops) fuerthii*	t.l. Panama Bay
Arius festae Boulenger, 1898	Species inquirendum (possibly valid)	t.l. Western Ecuador
Arius fuerthii Steindachner, 1877	v. as *C. (Cathorops) fuerthii*	d. Costa Rica to Panama
Tachisurus gulosus Eigenmann and Eigenmann, 1888	j.s. of *C. (Cathorops) hypophthalmus*	t.l. Panama
Arius hypophthalmus Steindachner, 1877	v. as *C. (Cathorops) hypophthalmus*	d. Panama
Tachysurus liropus Bristol in Gilbert, 1897	v. as *C. (Cathorops) liropus*	d. Mexico
Tachisurus longicephalus Eigenmann and Eigenmann, 1888	j.s. of *C. (Precathorops) dasycephalus*	t.l. Gulf of Panama
Cathorops manglarensis Marceniuk, 2007	v. as *C. (Cathorops) manglarensis*	d. Colombia
Cathorops raredonae new species	v. as *C. (Cathorops) raredonae*	d. Mexico to El Salvador
Arius multiradiatus Günther, 1864	v. as *C. (Cathorops) multiradiatus*	d. Panama to Peru
Tachysurus steindachneri Gilbert and Starks, 1904	v. as *C. (Cathorops) steindachneri*	d. El Salvador to Panama
Arius taylori Hildebrand, 1925	v. as *C. (Cathorops) taylori*	d. Guatemala to El Salvador
Arius tuyra Meek and Hildebrand, 1923	v. as *C. (Cathorops) tuyra*	d. Panama

The major taxonomic problems among the Eastern Pacific species of *Cathorops* have concerned the uncertain statuses of *A. festae*, described from Naranjal (Guayas River basin) in Ecuador, *C. liropus*, described from Ahome River in Mexico, *C. taylori*, described from Lempa River in El Salvador, and the ambiguous delimitation of *C. fuerthii* and *C. steindachneri*, both described from Panama. Despite the geographic and morphological differences, recent taxonomic accounts have listed *C. liropus* and *C. taylori* as junior synonyms of *C. fuerthii* and *C. steindachneri*, respectively. These synonymies were originally proposed by Kailola and Bussing (1995) and maintained by other authors without providing thorough revisions (e.g., Castro-Aguirre et al., 1999; Kailola, 2004; Marceniuk and Menezes, 2007). Other taxonomic studies treat *C. liropus* as species inquirenda (Marceniuk and Ferraris, 2003; Ferraris, 2007) and *C. taylori* as valid (Allen and Robertson, 1994; Betancur-R. et al., 2007; Marceniuk and Betancur-R., 2008; Robertson and Allen, 2008).

The results obtained during this study provide clarification for many of the issues concerning the alpha taxonomy of *Cathorops* from the Eastern Pacific, particularly from Mexico and Central America, such as the validation of *C. liropus* and *C. taylori*, the clarification of the limits and synonyms of *C. fuerthii* (*T. evermanni* is a junior synonym) and *C. steindachneri*, and the description of *C. raredonae* from Mesoamerica. Although the variation observed among some species of *Cathorops* from the west coast of Mexico requires further investigation (see Remarks of *C. liropus*), this study provides significant progress towards our understanding of *Cathorops* taxonomy from the Eastern Pacific.

Arius festae has been listed as species inquirendae (Marceniuk and Ferraris, 2003; Marceniuk and Menezes, 2007) or as possible synonym of *C. tuyra* (Betancur-R. and Acero P., 2004). Preliminary information based on third-party examination and photographs of the holotype of *A. festae* as well as molecular data obtained from material collected near its type locality (R. Betancur-R., unpubl. data) suggest that *A. festae* is a valid species in *Cathorops,* closely related to *C. multiradiatus.* Furthermore, the presence of large and globular teeth on accessory tooth patches (vs small teeth in all other Eastern Pacific species, except *C. tuyra*), fleshy portion of dorsomedial groove of neurocranium inconspicuous, wide and shallow, not continuous to the level of posterior nares (vs fleshy dorsomedial groove of neurocranium conspicuous, narrow and deep, continuous to the level of posterior nares in *C. steindachneri*), osseous portion of dorsomedial groove of neurocranium conspicuous and deep, with straight margins tapering posteriorly (vs osseous dorsomedial groove inconspicuous and remarkably shallow, with irregular margins parallel along its entire extension in *C. fuerthii*), caudal-fin lobes wide and rounded posteriorly (vs caudal-fin lobes narrow and pointed posteriorly in *C. hypophthalmus*, *C. liropus*, *C. steindachneri*, *C. taylori*, and *C. tuyra*), and 18 anal-fin rays (vs 19 or more anal-fin rays in other Eastern Pacific species), indicate that *A. festae* is not a synonym of any *Cathorops* species from the Eastern Pacific. Clarification of the taxonomic status and redescription of this nominal species is the subject of a future publication and awaits direct examination of the holotype and additional material recently collected by J. Maldonado in Ecuador (Museu Nacional do Rio de Janeiro, Brazil).

Identification Key to the Species of *Cathorops* from the Eastern Pacific

1a. Osseous bridge formed by lateral ethmoid and frontal with bony spinulations (more pronounced in females); vomerine tooth plates present; accessory tooth plates bearing conical teeth; mesial gill rakers on first two arches absent ..... *Cathorops (Precathorops) dasycephalus*

1b. Osseous bridge formed by lateral ethmoid and frontal without bony spinulations; vomerine tooth plates absent; accessory tooth plates bearing molariform teeth; mesial gill rakers on first two arches developed ..... subgenus *Cathorops*... 2

2a. Eye located at the same level or lower than the angle of mouth; gill rakers on first and second arches 37–40; distance between anterior nostrils 6.9%–7.1% SL; distance between posterior nostrils 8.2%–8.5% SL ..... *Cathorops hypophthalmus*

2b. Eye dorsal to the angle of mouth; gill rakers on first and second arches 13–22; distance between anterior nostrils 3.0%–6.0% SL; distance between posterior nostrils 4.0%–8.0% SL 3

3a. Anal fin rays 25–27 4

3b. Anal fin rays 19–24 5

4a. Posterior margin of pectoral-fin spine with short and inconspicuous serrations; dorsal fin spine shorter than pectoral fin spine; maxillary barbel 28.4%–38.2% SL ..... *Cathorops manglarensis*

4b. Posterior margin of pectoral-fin spine with long and conspicuous serrations; dorsal fin spine longer than pectoral fin spine; maxillary barbel 22.9%–27.7% SL ..... *Cathorops multiradiatus*

5a. Gill rakers on first arch 19–22; lips quite thick; molariform teeth on accessory tooth plates comparatively large; posterior expansion of dentary very long, with very large molariform teeth ..... *Cathorops tuyra*

5b. Gill rakers on first arch 13–18 (rarely 19 in *C. liropus*); lips thin; molariform teeth on accessory tooth plates comparatively small; posterior expansion of dentary comparatively short, with small to moderate molariform teeth 7

6a. Dorsal-fin spine remarkably thinner than pectoral-fin spine (Fig. 4A,C); caudal-fin lobes wide and rounded posteriorly (Fig. 4A,C); orbital diameter 40.1%–54.4% of caudal peduncle depth 7

6b. Dorsal-fin spine thicker or as thick as pectoral-fin spine; caudal-fin lobes narrow and pointed posteriorly (Fig. 4D,C); orbital diameter 55.7%–80.2% of caudal peduncle depth 9

7a. Anal-fin base length 21.0%–24.5% SL; restricted to South America ..... *Cathorops manglarensis*

7b. Anal-fin base length 14.7–20.9% SL; restricted to Central America 8

8a. Osseous dorsomedial groove of neurocranium inconspicuous and remarkably shallow, with irregular margins parallel along its entire extension (Fig. 3A); distance between snout and maxillary barbel 2.3%–3.2% SL; supraoccipital process length 39.9%–41.7% of caudal-fin lower lobe length ..... *Cathorops fuerthii*

8b. Osseous dorsomedial groove of neurocranium conspicuous and deep, with straight margins tapering posteriorly (Fig. 5C); distance between snout and maxillary barbel 1.3%–2.2% SL; supraoccipital process length 30.7%–35.3% of caudal-fin lower lobe length .... *Cathorops raredonae*

9a. Fleshy portion of dorsomedial groove of neurocranium conspicuous, deep and narrow (Fig. 2B) ..... *Cathorops steindachneri*

9b. Fleshy portion of dorsomedial groove of neurocranium inconspicuous, wide and shallow (Fig. 5E) 10

10a. Supraoccipital process length 9.4%–10.6% SL; nuchal plate length 96.6%–132.6% of width of cephalic shield at frontal area ..... *Cathorops taylori*

10b. Supraoccipital process length 10.9%–13.9% SL; nuchal plate length 82.2%–95.8% of width of cephalic shield at frontal area ..... *Cathorops liropus*

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APPENDIX I

DIAGNOSES FOR GENUS AND SUBGENUS *CATHOROPS* AMONG OTHER NEW WORLD ARIID GENERA*

*Based on Betancur-R. et al. (2007), Marceniuk and Menezes (2007), and Marceniuk and Betancur-R. (2008).

The genus *Cathorops* can be diagnosed from other New World ariid genera by having accessory tooth plates small and oval (vs large, round to subtriangular in *Amphiarius* and some *Notarius* and *Sciades*, longitudinally elongated in *Aspistor*, *Occidentarius*, some *Notarius* and *Sciades* or absent in *Potamarius*), dentary with posterior expansion in females (vs dentary without posterior expansion in other ariid genera with exception of *Potamarius*), extrascapular subtriangular, contacting the supraoccipital through a suture parallel to the longitudinal axis (vs extrascapular subrectangular or subquadrangular with oblique suture in other genera), base of adipose fin quite short, less than one-half the length of anal-fin base (vs about half as long as anal-fin base in *Genidens*, *Notarius*, *Potamarius* and *Sciades* or as long as anal-fin base in *Amphiarius*, *Aspistor*, and *Galeichthys*), and lateral line not bifurcated at caudal region, reaching base of caudal-fin upper lobe (vs bifurcated at caudal region, reaching base of caudal-fin upper and lower lobes in *Bagre*).

The subgenus *Cathorops*, within which the species described here are included, can be diagnosed from the subgenus *Precathorops* and from other ariid genera by possessing a lateral ethmoid and frontal limiting a wide conspicuous fenestra, visible under the skin (vs moderately developed in *Precathorops*, *Amphiarius*, *Aspistor*, *Bagre*, *Galeichthys*, *Notarius*, and *Potamarius* or reduced or absent in *Genidens*, *Sciades*, and *Occidentarius*), mesethmoid, lateral ethmoid and frontal lacking bony spinulations (vs bony spinulations present in *Precathorops*), posterior cranial fontanel very reduced (vs moderately developed, long and narrow in *Precathorops*, *Notarius*, and *Potamarius*, large and long in *Amphiarius* and *Aspistor*, or absent in *Sciades*), vomerine tooth plates absent (vs present in *Precathorops*, *Aspistor*, *Bagre*, *Galeichthys*, *Notarius*, *Occidentarius*, and *Sciades*), accessory tooth plates bearing molariform teeth (vs conical in *Precathorops*, and in other ariid genera except *Aspistor*), posterior cleithral process short (vs moderate length in *Precathorops* and other ariid genera), and mesial gill rakers on first two arches developed (vs absent or reduced in *Precathorops*, *Amphiarius*, *Aspistor*, *Bagre*, *Notarius*, *Occidentarius*, and *Sciades*).